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Project/Task WAG 7 Data Compilation
Subtask Lithology and Perched Water

TITLE: SDA Lithology and Perched Water Data Compilation

SUMMARY

The summary briefly defines the problem or activity to be addressed in the EDF, gives a summary of activities performed in addressing the problem and states the conclusions, recommendations, or results arrived at from this task.

This report discusses the lithology of the unsaturated zone and the presence of perched water in the unsaturated zone at the Radioactive Waste Management Complex (RWMC). The lithology section of the report identifies the thickness and elevation of basalt flow groups, sedimentary interbeds, and surficial sediment. The information was interpreted from geologic data collected from 72 wells. The perched water section of the report compiles perched water hydrographs from four previous reports. Perched water has been detected in the surficial sediments, above the 110-ft interbed, and above the 240-ft interbed.

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SDA Lithology and Perched Water Data Compilation

Roseanna M. Neupauer

1.0 Introduction

This report discusses the lithology of the unsaturated zone in the area of the Radioactive Waste Management Complex (RWMC). It also discusses the existence of perched groundwater in the unsaturated zone at the RWMC area. The purpose of this report is to summarize all available information from previous reports in one document.

2.0 Lithology

The unsaturated zone in the RWMC area is made up of basaltic lava flows and sedimentary interbeds, and is overlain by a thin layer of surficial sediment. The flows can be subdivided into 11 basalt flow groups. These flow groups are named A, B, C, C3, D, E, F, FG, G, H, and I, in sequence from land surface. Sedimentary interbeds lie between the flow groups and are named according to the overlying and underlying flow groups. The interbeds include A-B, B-C, C2-C3, C-D, D-E, E-F, F-FG, F-G, FG-G, G-I,G-H, and H-I. Sedimentary interbeds A-B, B-C, and C-D are also known as 30-ft, 110-ft, and 240-ft interbeds, respectively, based on their average depth below land surface (Barraclough et al., 1976).

Lithology of the unsaturated zone in the RWMC area is described in this section. Data collected from 72 wells in the vicinity of the RWMC was used to identify surficial sediment thickness, elevation and thickness of basalt flow groups, and elevation and thickness of sedimentary interbeds. Most of the information (45 wells) was taken from Anderson and Lewis (1989). Information on the remaining wells was obtained from Burgess et al. (1994) (12 wells) and Parsons (1995) (15 wells). This section summarizes the data available from these reports.

2.1 Previous Studies on Lithology

Anderson and Lewis (1989) discuss the stratigraphic framework of the unsaturated zone in the RWMC area. The information is interpreted from geologic and geophysical data collected from June 1971 to September 1988. Lithology data from 45 wells was used to identify surficial sediment thickness, location and thickness of basalt flow groups, and location and thickness of sedimentary interbeds. Contour maps showing altitude and thickness of interbeds were presented in Anderson and Lewis (1989). A table showing altitude and thickness of interbeds and flow groups at each well was also presented. Locations of the wells are shown in Figure 1.

Burgess et al. (1994) is the summary report for the Waste Area Group 7 (WAG 7) Groundwater Pathway Track 2 study. Included in that report are borehole logs for six monitoring

wells and six vadose zone wells completed for the study. Locations of the wells are shown in Figure 2. Lithologic information was not interpreted from these borehole logs in Burgess et al. (1994). Therefore, for this EDF, the lithologic information was interpreted from the borehole logs and was used to update the information from Anderson and Lewis (1989).

Parsons (1995) is the well completion report for 15 additional wells drilled at the RWMC during 1994. The locations of the wells are shown in Figure 3. Lithologic interpretations were presented on the borehole logs for these wells. This information was used to update the stratigraphic information discussed in Anderson and Lewis (1989). None of the wells drilled in 1994 penetrate below the C-D interbed.

2.2 Surficial Sediment

Basaltic rocks in the RWMC area are overlain in most places by a thin layer of surficial sediment. The surficial sediment is fully penetrated by 72 wells. The base of the surficial sediment is at a depth range of 2 to 23 ft and ranges in elevation from 4986 to 5029 ft above msl. The thickness ranges from 0 to 23 ft, with an average thickness of 10 ft.The average thickness is the arithmetic average of the thicknesses measured in all wells. The surficial sediment data is summarized in Table 1 (Anderson and Lewis, 1989; Burgess et al., 1994; and Parsons, 1995).

2.3 Basalt Flow Groups

Characteristics of each basalt flow group at the RWMC are presented below and summarized in Table 2. The information is taken from Anderson and Lewis (1989) and updated to include additional wells drilled since that time. Additional information can be found in Anderson and Lewis (1989), Burgess et al. (1994), and Parsons (1995).

2.3.1 Basalt Flow Group A

Flow group A is fully penetrated by 32 wells and not detected in 40 wells. The top of the flow group is at a depth range of 2 to 20 ft and ranges in elevation from 4990 to 5024 ft above msl. The base of the flow group is at a depth range of 18 to 46 ft and ranges in elevation from 4966 to 4996 ft above msl. The thickness of this flow group ranges from 0 to 43 ft, with an average thickness of 21 ft.

2.3.2 Basalt Flow Group B

Flow group B is fully or partially penetrated by 72 wells. In these wells, the top of the flow group is at a depth range of 1 to 55 ft and ranges in elevation from 4962 to 5064 ft above msl. The base of the flow group is at a depth range of 87 to 166 ft and ranges in elevation from 4881 to 4931 ft above msl. The thickness of this flow group ranges from 38 to 164 ft, with an average thickness of 80 ft.

2.3.3 Basalt Flow Group C

Flow group C is fully or partially penetrated by 65 wells. In these wells, the top of the flow group is at a depth range of 88 to 179 ft and ranges in elevation from 4841 to 4922 ft above msl. The base of the flow group is at a depth range of 218 to 321 ft and ranges in elevation from 4734 to 4801 ft above msl. The thickness of this flow group ranges from 82 to 168 ft, with an average thickness of 115 ft.

2.3.4 Basalt Flow Group C3

Flow group C3 was identified in Burgess et al. (1994). It is fully penetrated by one well, M6S, and not detected in 35 wells. The top is 289 ft below land surface at an elevation of 4776 ft above msl. The base is 320 ft below land surface at an elevation of 4745 ft above msl. The thickness is 31 ft.

2.3.5 Basalt Flow Group D

Flow group D is fully or partially penetrated by 35 wells. In these wells, the top of the flow group is at a depth range of 225 to 339 ft and ranges in elevation from 4726 to 4788 ft above msl. The base of the flow group is at a depth range of 261 to 387 ft and ranges in elevation from 4708 to 4752 ft above msl. The thickness of this flow group ranges from 8 to 88 ft, with an average thickness of 34 ft.

2.3.6 Basalt Flow Group E

Flow group E is fully or partially penetrated by 18 wells. In these wells, the top of the flow group is at a depth range of 267 to 392 ft and ranges in elevation from 4673 to 4746 ft above msl. The base of the flow group is at a depth range of 357 to 434 ft and ranges in elevation from 4605 to 4662 ft above msl. The thickness of this flow group ranges from 42 to 114 ft, with an average thickness of 84 ft.

2.3.7 Basalt Flow Group F

Flow group F is fully or partially penetrated by 16 wells. In these wells, the top of the flow group is at a depth range of 359 to 434 ft and ranges in elevation from 4605 to 4656 ft above msl. The base of the flow group is at a depth range of 487 to 638 ft and ranges in elevation from 4432 to 4525 ft above msl. The thickness of this flow group ranges from 84 to 238 ft, with an average thickness of 171 ft.

2.3.8 Basalt Flow Group FG

Flow group FG is fully penetrated by 2 wells. In these wells, the top of the flow group is at a depth range of 548 to 551 ft and ranges in elevation from 4454 to 4481 ft above msl. The base of the flow group is at a depth range of 561 ft to 569 ft and ranges in elevation from 4450 to 4460 ft above msl. The thickness of this flow group ranges from 4 to 21 ft, with an average thickness of 13 ft.

2.3.9 Basalt Flow Group G

Flow group G is fully or partially penetrated by 14 wells. In these wells, the top of the flow group is at a depth range of 493 to 636 ft and ranges in elevation from 4420 to 4519 ft above msl. The base of the flow group is at a depth range of 600 to 664 ft and ranges in elevation from 4356 to 4423 ft above msl. The thickness of this flow group ranges from 40 to 123 ft, with an average thickness of 75 ft.

2.3.10 Basalt Flow Group H

Flow group H is fully penetrated by 6 wells and was undetected in two wells. The top of the flow group is at a depth range of 605 to 672 ft and ranges in elevation from 4363 to 4411 ft above msl. The base of the flow group is at a depth range of 620 to 687 ft and ranges in elevation from 4338 to 4396 ft above msl. The thickness of this flow group ranges from 3 to 27 ft, with an average thickness of 17 ft.

2.3.11 Basalt Flow Group I

Flow group I is partially penetrated by 6 wells. In these wells, the top of the flow group is at a depth range of 602 to 673 ft and ranges in elevation from 4332 to 4388 ft above msl. The maximum thickness explored in this flow group is 236 ft.

2.4 Sedimentary Interbeds

Characteristics of each sedimentary interbed at the RWMC are presented below and summarized in Table 3. The information is taken from Anderson and Lewis (1989) and updated to include additional wells drilled since then. Additional information can be found in Anderson and Lewis (1989), Burgess et al. (1994), and Parsons (1995).

2.4.1 Interbed A-B

Sedimentary interbed A-B is fully penetrated by 32 wells and was not detected in 40 wells. The top of the interbed is at a depth range of 18 to 46 ft and ranges in elevation from 4966 to 4996 ft above msl. The base of the interbed is at a depth range of 22 to 55 ft and ranges in elevation from 4962 to 4990 ft above msl. The thickness of this interbed ranges from 0 to 11 ft, with an average thickness of 5 ft.

2.4.2 Interbed B-C

Sedimentary interbed B-C is fully or partially penetrated by 65 wells and was not detected in four wells. The top of the interbed is at a depth range of 87 to 166 ft and ranges in elevation from 4881 to 4939 ft above msl. The base of the interbed is at a depth range of 91 to 179 ft and ranges in elevation from 4841 to 4921 ft above msl. The thickness of this interbed ranges from 0 to 40 ft, with an average thickness of 13 ft.

2.4.3 Interbed C2-C3

Sedimentary interbed C2-C3 was identified in Burgess et al. (1994). It is penetrated by one well, M6S, and was not detected in 54 wells. The top of the interbed is at a depth of 285 ft below land surface and at an elevation of 4780 ft above msl. The base of the interbed is at a depth of 289 ft below land surface and at an elevation of 4776 ft above msl. The thickness is 4 ft.

2.4.4 Interbed C-D

Sedimentary interbed C-D is fully or partially penetrated by 55 wells. In these wells, the top of the interbed is at a depth range of 218 to 321 ft and ranges in elevation from 4734 to 4801 ft above msl. The base of the interbed is at a depth range of 228 to 339 ft and ranges in elevation from 4710 to 4788 ft above msl. The thickness of this interbed ranges from 3 to 32 ft, with an average thickness of 15 ft.

2.4.5 Interbed D-E

Sedimentary interbed D-E is fully or partially penetrated by 15 wells and was not detected in three wells. The top of the interbed is at a depth range of 261 to 387 ft and ranges in elevation from 4677 to 4752 ft above msl. The base of the interbed is at a depth range of 267 to 392 ft and ranges in elevation from 4673 to 4746 ft above msl. The thickness of this interbed ranges from 0 to 16 ft, with an average thickness of 6 ft.

2.4.6 Interbed E-F

Sedimentary interbed E-F is fully penetrated by 6 wells and was not detected in ten wells. The top of the interbed is at a depth range of 357 to 378 ft and ranges in elevation from 4635 to 4662 ft above msl. The base of the interbed is at a depth range of 362 to 384 ft and ranges in elevation from 4631 to 4656 ft above msl. The thickness of this interbed ranges from 0 to 6 ft, with an average thickness of 5 ft.

2.4.7 Interbeds F-G, F-FG, and FG-G

Sedimentary interbed F-G is fully or partially penetrated by 14 wells and was not detected in two wells. The top of the interbed is at a depth range of 487 to 628 ft and ranges in elevation from 4432 to 4525 ft above msl. The base of the interbed is at a depth range of 493 to 636 ft and ranges in elevation from 4420 to 4519 ft above msl. The thickness of this interbed ranges from 4 to 15 ft, with an average thickness of 8 ft.

Sedimentary interbed F-FG is penetrated by two wells and was not detected in 14 wells. The top of the interbed is at a depth range of 540 to 580 ft and ranges in elevation from 4461 to 4489 ft above msl. The base of the interbed is at a depth range of 548 to 557 ft and ranges in elevation from 4454 to 4481 ft above msl. The thickness ranges from 5 to 8 ft, with an average thickness of 7 ft.

Sedimentary interbed FG-G is penetrated by two wells and was not detected in 14 wells. The top of the interbed is at a depth range of 561 to 569 ft and ranges in elevation from 4450 to 4460 ft above msl. The base of the interbed is at a depth range of 567 to 583 ft and ranges in elevation from 4444 to 4446 ft above msl. The thickness ranges from 6 to 14 ft, with an average thickness of 10 ft.

2.4.8 Interbeds G-I, G-H, and H-I

Sedimentary interbed G-I is penetrated by two wells and was not detected in seven wells. The top of the interbed is at a depth range of 600 to 618 ft below land surface and ranges in elevation from 4393 to 4423 ft above msl. The base of the interbed is at a depth range of 602 to 623 ft and ranges in elevation from 4387 to 4393 ft above msl. The thickness ranges from 2 to 5 ft, with an average thickness of 4 ft.

Sedimentary interbed G-H is penetrated by seven wells and was not detected in two wells. The top of the interbed is at a depth range of 600 to 664 ft and ranges in elevation from 4368 to 4416 ft above msl. The base of the interbed is at a depth range of 605 to 672 ft and ranges in elevation from 4363 to 4411 ft above msl. The thickness of this interbed ranges from 4 to greater than 15 ft, with an average thickness of 8 ft.

Sedimentary interbed H-I is penetrated by six wells and was not detected in two wells. The top of the interbed is at a depth range of 620 to 687 ft and ranges in elevation from 4338 to 4396 ft above msl. The base of the interbed is at a depth range of 639 to 696 ft and ranges in elevation from 4332 to 4374 ft above msl. The thickness of this interbed ranges from 4 to greater than 20 ft, with an average thickness of 9 ft.

2.5 Summary of Sampling Information

Tables 4 and 5 show the altitude and thickness of each interbed and flow group for each of the 72 wells. Table 4 is taken directly from Anderson and Lewis (1989) for the wells discussed in that report. Table 5 provides similar information for the remaining 27 wells.

3.0 Perched Water

Perched groundwater has been detected in the unsaturated zone at the RWMC. Several studies have documented the detection of perched water in surficial sediment, above the 110-ft interbed, and above the 240-ft interbed (Hubbell 1990, 1992, 1993, and 1994). Perched water zones are discontinuous and ephemeral. Sources of perched water include precipitation, flooding, and lateral movement of water from the spreading areas (Hubbell 1990).

Perched water levels were measured in various wells and boreholes in the RWMC area and the results have been presented in previous reports. This section summarizes the information available in the previous reports. Hydrographs of water level measurements in the various wells are provided.

3.1 Previous Studies on Perched Water

Hubbell (1990) assesses the presence, extent, source, and quality of perched groundwater at the RWMC. At that time, perched water had been detected in six wells--Wells USGS 92, USGS 93, USGS 96, 77-2, 78-1, and 8802D. Locations of these wells are shown in Figure 4. Water in wells USGS 92, USGS 93, USGS 96, and 8802D was detected above the 240-ft interbed; while water in the other wells was detected above the 110-ft interbed. Wells 93 and 96 have been cemented to land surface and no additional perched water measurements were made. Hubbell (1990) also discusses the chemical analysis of the perched water, perched water sources, and the extent of perched water at the RWMC.

Hubbell (1992) summarizes perched water sampling data that was collected from November 1991 to August 1992 in Wells USGS 92, 8802D, D-10, 77-2, and 78-1. Locations of these wells are shown in Figure 5. Perched water was detected above the 240-ft interbed in wells 92, 8802D, and D10. No water was detected in wells 77-2 and 78-1. Standing water was also detected in neutron access tube NAT-06 in surficial sediment. Water quality and water level elevations of perched water in these wells is also discussed in Hubbell (1992).

Hubbell (1993) summarizes perched water elevation data obtained from March 1993 to September 1993 in wells and shallow boreholes. Perched water was monitored in surficial sediment in the following boreholes: Acid Pit-borehole number 4 (AP-4), monitoring station number 4 (MS-4), and Pit 9-borehole number 6. Wells 77-2 and 78-1 were monitored for perched water above the 110-ft interbed. Wells USGS 92, 8802D, D10, 9301, and 9302 were monitored above the 240-ft interbed. Locations of these wells and boreholes are shown in Figure 6. Standing water was detected in all wells except 77-2 and 9301.

Hubbell (1994) summarizes perched water elevation data collected between October 1993 and September 1994 in boreholes and wells. Perched water was monitored in surficial sediment in the following boreholes: MS-4, Pit 9-borehole numbers 3 and 6, and neutron access tubes NAT-06, NAT-11, NAT-12, and NAT-13. Wells 77-2 and 78-1 were monitored for perched water above the 110-ft interbed. Wells USGS 92, 8802D, D10, 9301, and 9302 were monitored above the 240-ft interbed. Locations of these wells and boreholes are shown in Figure 6. Perched water was detected in all wells except Pit 9-#6, NAT-11, NAT-12, 77-2, and 9301.

3.2 Perched Water Hydrographs

Hydrographs are presented in this section for all wells and boreholes in which perched water was detected. The data for these hydrographs is too voluminous to include in this report. Joel Hubbell, Integrated Earth Sciences, is the custodian of the data.

This section is divided into three parts: hydrographs of perched water in surficial sediment, hydrographs of perched water above the 110-ft interbed, and hydrographs of perched water above the 240-ft interbed. Table 6 lists the perched water wells, years that perched water was detected, sample depth, and references.

3.2.1 Perched Water in Surficial Sediment

Perched water has been detected in seven shallow boreholes. These include AP-4, MS-4, NAT-06, NAT-13, NAT-16, Pit 9-#3, and Pit 9-#6. Hydrographs of the water levels in these boreholes are presented in the following figures.

Figure 7: Water level in Acid Pit Borehole number 4, 1993 (Hubbell, 1993).

Figure 8: Water level in Monitoring Station MS-4, 1993 (Hubbell, 1993).

Figure 9: Water level in Monitoring Station MS-4, 1994 (Hubbell, 1994).

Figure 10: Water level in Neutron Access Tube NAT-06, 1993-94 (Hubbell, 1994).

Figure 11. Water level in Neutron Access Tube NAT-13, 1994 (Hubbell, 1994).

Figure 12. Water level in Neutron Access Tube NAT-16, 1994 (Hubbell, 1994).

Figure 13. Water level in Pit 9 borehole number 3, 1994 (Hubbell, 1994).

Figure 14. Water level in Pit 9 borehole number 6, 1993 (Hubbell, 1993).

3.2.2 Perched Water above 110-ft Interbed

Perched water has been detected above the 110-ft interbed in two wells: 77-2 and 78-1. Hydrographs of the water levels in well 78-1 are presented in the following figures. Hydrographs of perched water levels in well 77-2 were not presented in the previous studies.

Figure 15. Water level in Well 78-1, 1993 (Hubbell, 1993).

Figure 16. Water level in Well 78-1, 1993-94 (Hubbell, 1994).

3.2.3 Perched Water above the 240-ft Interbed

Perched water has been detected above the 240-ft interbed in six wells. These include Wells 8802D, 9302, D10, USGS 92, USGS 93, and USGS96. Hydrographs are not available for USGS93 and USGS 96 since they were cemented to land surface after drilling. Hydrographs of the water levels in the remaining wells are presented in the following figures.

Figure 17. Water level in Well 8802D, 1992 (Hubbell, 1992).

Figure 18. Water level in Well 8802D, 1993 (Hubbell, 1993).

Figure 19. Water level in Well 8802D, 1993-94 (Hubbell, 1994).

Figure 20. Water level in Well 9302, 1993 (Hubbell, 1993).

Figure 21. Water level in Well 9302, 1993-94 (Hubbell, 1994).

Figure 22.Water level in Well D10, 1992 (Hubbell, 1992).

Figure 23. Water level in Well D10, 1993 (Hubbell, 1993).

Figure 24. Water level in Well D10, 1993-94 (Hubbell, 1994).

Figure 25. Water level in Well USGS 92, 1970-1990 (Hubbell, 1990).

Figure 26. Water level in Well USGS 92, 1992 (Hubbell, 1992).

Figure 27. Water level in Well USGS 92, 1993 (Hubbell, 1993).

Figure 28. Water level in Well USGS 92, 1993-94 (Hubbell, 1994).

4.0 References

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Appendix A

Tables

Table 1: Surficial sediment data for wells at RWMC

Borehole Number	Land Surface Elevation (ft)	Surficial Sediment Thickness (ft)	Basalt Elevation (ft)
8801D	5010	21	4989
8802D	5009	6	5003
8901D	5014.36	23	4991.36
VZT-1	5018	4	5014
RWMC	5005	7	4998
DO2	5012	13	4999
DO6	5012	3	5009
DO6A	5012	3	5009
D10	5014	9	5005
D15	5011	2	5009
76-1	5009	7	5002
76-2	5010	11	4999
76-3	5010	20	4990
76-4	5011	8	5003
76-4A	5011	6	5005
76-5	5011	11	5000
76-6	5011	5	5006
77-1	5017	4	5013
77-2	5014	18	4996
78-1	5010	19	4991
78-2	5007	6	5001
78-3	5011	11	5000
78-4	5018	5	5013
78-5	5010	12	4998
79-1	5018	3	5015
79-2	5011	13	4998
79-3	5008	13	4995
87	5017	3	5014
88	5020	6	5014
89	5029	9	5020
90	5010	5	5005
91	5006	11	4995
92	5008	20	4988
93	5010	15	4995
93A	5010	16	4994
94	5008	8	5000

Table 1: Surficial sediment data for wells at RWMC

Borehole Number	Land Surface Elevation (ft)	Surficial Sediment Thickness (ft)	Basalt Elevation (ft)
95	5008	22	4986
96	5009	16	4993
96B	5009	13	4996
96A	5007	13	4994
M1SA	5011[a]	4	5007
M3S	5016[a]	3	5013
M4D	5023[a]	5	5018
M6S	5065[a]	3	5062
M7S	5005[a]	6	4999
M10S	5021[a]	2	5019
OCVZ-1	5011[a]	4	5007
OCVZ-3A	5015[a]	4	5011
OCVZ-4	5022[a]	2	5020
OCVZ-6	5066[a]	2	5064
OCVZ-7	5004[a]	4	5001
OCVZ-10	5021[a]	1	5020
1E	5010	15	4995
1V	5010	9	5001
2E	5011	17	4994
2V	5009	7	5002
3E	5014	6	5008
3V	5012	15	4997
4E	5017	23	4994
4V	5015	13	5002
5E	5016	21	4995
5V	5014	22	4992
6V	5017	10	5007
7V	5012	16	4996
8V	5016	21	4995
9V	5017	22	4995
10V	5016	10	5006

[a] Beard, 1993

Table 2: Characteristics of Basalt Flow Groups at RWMC

Flow Group	Number of wells	Depth of top (ft)	Elevation of top(ft)	Depth of base (ft)	Elevation of base (ft)	Thickness range (ft)	Average Thickness (ft)
A	32	2 to 20	4,990 to 5,024	18 to 46	4,966 to 4,996	0 to 43	21
B	72	1 to 55	4,962 to 5,064	87 to 166	4,881 to 4,931	38 to 164	80
C	65	88 to 179	4,841 to 4,922	218 to 321	4,734 to 4,801	82 to 168	115
C3	1	289	4,776	320	4,745	31	31
D	35	225 to 339	4,726 to 4,788	261 to 387	4,708 to 4,752	8 to 88	34
E	18	267 to 392	4,673 to 4,746	357 to 434	4,605 to 4,662	42 to 114	84
F	16	359 to 434	4,605 to 4,656	487 to 638	4,432 to 4,525	84 to 238	171
FG	2	548 to 551	4,454 to 4,481	561 to 569	4,450 to 4,460	4 to 21	13
G	14	493 to 636	4,420 to 4,519	600 to 664	4,356 to 4,423	40 to 123	75
H	6	605 to 672	4,363 to 4,411	620 to 687	4,338 to 4,396	3 to 27	17
I	6	602 to 673	4,332 to 4,388	-	-	-	236[a]

a. Maximum explored thickness

Table 3: Characteristics of Sedimentary Interbeds at RWMC

Interbed	Number of wells	Depth of top (ft)	Elevation of top(ft)	Depth of base (ft)	Elevation of base (ft)	Thickness range (ft)	Average Thickness (ft)
A-B	32	18 to 46	4,966 to 4,996	22 to 55	4,962 to 4,990	0 to 11	5
B-C	65	87 to 166	4,881 to 4,939	91 to 179	4,841 to 4,921	0 to 40	13
C2-C3	1	285	4,780	289	4,776	4	4
C-D	55	218 to 321	4,734 to 4,801	228 to 339	4,710 to 4,788	3 to 32	15
D-E	15	261 to 387	4,677 to 4,752	267 to 392	4,673 to 4,746	0 to 16	6
E-F	6	357 to 378	4,635 to 4,662	362 to 384	4,631 to 4,656	0 to 6	5
F-G	14	487 to 628	4,432 to 4,525	493 to 636	4,420 to 4,519	4 to 15	8
F-FG	2	540 to 580	4,461 to 4,489	548 to 557	4,454 to 4,481	5 to 8	7
FG-G	2	561 to 569	4,450 to 4,460	567 to 583	4,444 to 4,446	6 to 14	10
G-I	2	600 to 618	4,393 to 4,423	602 to 623	4,387 to 4,393	2 to 5	4
G-H	7	600 to 664	4,368 to 4,416	605 to 672	4,363 to 4,411	4 to >15	8
H-I	6	620 to 687	4,338 to 4,396	639 to 696	4,332 to 4,374	4 to >20	9

Table 4. Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled prior to 1989 (from Anderson and Lewis, 1989).

	Surficial Sediment		Basalt flow group A			Sedimentary interbed A-B		
Well	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base
76-1	7	5002	5002	20	4982	4982	6	4976
76-2	11	4999	4999	10	4989	4989	4	4985
76-3	20	4990	4990	2	4988	4988	3	4985
76-4	8	5003	5003	10	4993	4993	4	4989
76-4A	6	5005	5005	12	4993	4993	5	4988
76-5	11	5000	--	0	--	--	0	--
76-6	5	5006	--	0	--	--	0	--
77-1	4	5013	5013	36	4977	4977	8	4969
77-2	18	4996	4996	10	4986	4986	3	4983
78-1	19	4991	--	0	--	--	0	--
78-2	6	5001	5001	14	4987	4987	4	4983
78-3	11	5000	--	0	--	--	0	--
78-4	3	5015	5015	39	4976	4976	5	4971
78-5	12	4998	--	0	--	--	0	--
79-1	5	5013	--	0	--	--	0	--
79-2	13	4998	4998	11	4987	4987	3	4984
79-3	13	4995	--	0	--	--	0	--
87	2	5014	5014	38	4976	4976	8	4968
88	6	5014	--	0	--	--	0	--
88-01D	21	4989	--	0	--	--	0	--
88-02D	6	5003	5003	19	4984	4984	3	4981
89	9	5020	5020	24	4996	4996	6	4990
90	5	5005	--	0	--	--	0	--
91	11	4995	--	0	--	--	0	--
92	20	4988	--	0	--	--	0	--
93	15	4995	--	0	--	--	0	--
93-A	16	4994	--	0	--	--	0	--
94	8	5000	--	0	--	--	0	--
95	22	4986	--	0	--	--	0	--
96	16	4993	--	0	--	--	0	--
96-A	13	4994	4994	19	4975	4975	2	4973
96-B	13	4996	4996	18	4978	4978	7	4971
117	16	4997	--	0	--	--	0	--
118	15	4998	--	0	--	--	0	--
119	3	5029	--	0	--	--	0	--
120	13	4999	--	0	--	--	0	--
D-02	13	4999	4999	11	4988	4988	4	4984
D-06	3	5009	5009	36	4973	4973	11	4962
D-06A	3	5009	5009	43	4966	4966	2	4964
D-10	9	5005	5005	23	4982	4982	7	4975
D-15	2	5009	5009	30	4979	4979	3	4976
RWMC	7	4998	--	0	--	--	0	--
TW-1	17	4994	4994	9	4985	4985	4	4981
WWW-1	5	5024	5024	39	4985	4985	11	4974
VZT-1	4	5014	5014	39	4975	4975	7	4968

Table 4. Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled prior to 1989 (from Anderson and Lewis, 1989). (cont).

	Basalt flow group B			Sedimentary interbed B-C			Basalt flow group C		
Well	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base
76-1	4976	55	4921	--	0	--	4921	132	4789
76-2	4985	65	4920	--	0	--	4920	131	4789
76-3	4985	69	4916	4916	24	4892	4892	100	4792
76-4	4989	72	4917	4917	5	4912	4912	>116	<4796
76-4A	4988	72	4916	4916	4	4912	4912	124	4788
76-5	5000	82	4918	4918	17	4901	4901	110	4791
76-6	5006	93	4913	4913	4	4909	4909	126	4783
77-1	4969	50	4919	4919	6	4913	4913	124	4789
77-2	4983	>56	<4927	--	--	--	--	--	--
78-1	4991	>63	<4928	--	--	--	--	--	--
78-2	4983	69	4914	4914	7	4907	4907	123	4784
78-3	5000	85	4915	--	0	--	4915	129	4786
78-4	4971	53	4918	4918	5	4913	4913	123	4790
78-5	4998	86	4912	4912	25	4887	4887	100	4787
79-1	5013	108	4905	4905	28	4877	4877	86	4791
79-2	4984	71	4913	4913	5	4908	4908	>120	<4788
79-3	4995	87	4908	4908	7	4901	4901	125	4776
87	4968	56	4912	--	0	--	4912	124	4788
88	5014	101	4913	4913	11	4902	4902	116	4786
88-010	4989	81	4908	4908	5	4903	4903	122	4781
88-020	4981	66	4915	4915	8	4907	4907	>27	<4880
89	4990	59	4931	4931	14	4917	4917	116	4801
90	5005	97	4908	4908	23	4885	4885	115	4770
91	4995	86	4909	4909	16	4893	4893	116	4777
92	4988	67	4921	4921	5	4916	4916	130	4786
93	4995	78	4917	4917	13	4904	4904	115	4789
93-A	4994	83	4911	4911	12	4899	4899	111	4788
94	5000	88	4912	4912	16	4896	4896	113	4783
95	4986	75	4911	4911	14	4897	4897	112	4785
96	4993	81	4912	4912	27	4885	4885	100	4785
96-A	4973	62	4911	4911	>22	<4889	--	--	--
96-B	4971	62	4909	4909	25	4884	4884	96	4788
117	4997	77	4920	4920	11	4909	4909	117	4792
118	4998	88	4910	4910	10	4900	4900	108	4792
119	5029	110	4919	4919	5	4914	4914	131	4783
120	4999	118	4881	4881	40	4841	4841	82	4759
O-02	4984	70	4914	4914	5	4909	4909	120	4789
O-06	4962	38	4924	4924	3	4921	4921	>35	<4886
O-06A	4964	>2	<4962	--	--	--	--	--	--
O-10	4975	56	4919	4919	>0	<4919	--	--	--
O-15	4976	63	4913	4913	14	4899	4899	110	4789
RWMC	4998	88	4910	4910	10	4900	4900	120	4780
TW-1	4981	71	4910	4910	7	4903	4903	118	4785
WWW-1	4974	50	4924	4924	14	4910	4910	112	4798
VZT-1	4968	50	4918	4918	18	4900	4900	>16	<4884

Table 4. Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled prior to 1989 (from Anderson and Lewis, 1989). (cont).

	Sedimentary interbed C-D			Basalt flow group D		
Well	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base
76-1	4789	>8	<4781	--	--	--
76-2	4789	>31	<4758	--	--	--
76-3	4792	>22	<4770	--	--	--
76-4	--	--	--	--	--	--
76-4A	4788	>31	<4757	--	--	--
76-5	4791	20	4771	4771	>5	<4766
76-6	4783	6	4777	4777	>10	<4767
77-1	4789	22	4767	4767	30	4737
77-2	--	--	--	--	--	--
78-1	--	--	--	--	--	--
78-2	4784	>30	<4754	--	--	--
78-3	4786	>26	<4760	--	--	--
78-4	4790	20	4770	4770	38	4732
78-5	4787	>27	<4760	--	--	--
79-1	4791	5	4786	4786	>12	<4774
79-2	--	--	--	--	--	--
79-3	4776	25	4751	4751	>5	<4746
87	4788	17	4771	4771	35	4736
88	4786	32	4754	4754	8	4746
88-010	4781	>4	<4777	--	--	--
88-020	--	--	--	--	--	--
89	4801	20	4781	4781	31	4750
90	4770	7	4763	4763	55	4708
91	4777	13	4764	4764	>13	<4751
92	4786	24	4762	4762	>1	<4761
93	4789	9	4780	4780	>16	<4764
93-A	4788	10	4778	4778	>1	<4777
94	4783	21	4762	4762	28	4734
95	4785	12	4773	4773	>11	<4762
96	4785	6	4779	4779	>6	<4773
96-A	--	--	--	--	--	--
96-B	4788	>8	<4780	--	--	--
117	4792	32	4760	4760	8	4752
118	4792	29	4763	4763	47	4716
119	4783	20	4763	4763	35	4728
120	4759	14	4745	4745	14	4731
D-02	4789	>20	<4769	--	--	--
D-06	--	--	--	--	--	--
D-06A	--	--	--	--	--	--
D-10	--	--	--	--	--	--
D-15	4789	17	4772	4772	>5	<4767
RWMC	4780	12	4768	4768	53	4715
TW-1	4785	>12	<4773	--	--	--
WWW-1	4798	21	4777	4777	>6	<4771
VZT-1	--	--	--	--	--	--

Table 4. Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled prior to 1989 (from Anderson and Lewis, 1989). (cont).

	Sedimentary interbed D-E			Basalt flow group E			Sedimentary interbed E-F		
Well	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base
77-1	4737	9	4728	4728	71	4657	4657	5	4652
78-4	4732	4	4728	4728	>53	<4675	--	--	--
87	--	0	--	4736	80	4656	4656	5	4651
88	4746	4	4742	4742	100	4642	4642	6	4636
89	4750	6	4744	4744	82	4662	4662	6	4656
90	--	0	--	4708	73	4635	4635	4	4631
94	4734	4	4730	4730	>24	<4706	--	--	--
117	4752	6	4746	4746	92	4654	--	0	--
118	4716	6	4710	4710	78	4632	--	0	--
119	4728	7	4721	4721	92	4629	--	0	--
120	4731	8	4723	4723	114	4609	--	0	--
RWMC	--	0	--	4715	83	4632	--	0	--

	Basalt flow group F			Sedimentary interbed F-FG			Basalt flow group FG		
Well	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base
77-1	4652	189	4463	--	--	--	--	--	--
78-4	--	--	--	--	--	--	--	--	--
87	4651	185	4466	--	--	--	--	--	--
88	4636	133	4503	--	--	--	--	--	--
89	4656	167	4489	4489	8	4481	4481	21	4460
90	4631	199	4432	--	--	--	--	--	--
94	--	--	--	--	--	--	--	--	--
117	4654	167	4487	--	--	--	--	--	--
118	4632	186	4446	--	--	--	--	--	--
119	4629	169	4460	--	--	--	--	--	--
120	4609	84	4525	--	--	--	--	--	--
RWMC	4632	191	4441	--	--	--	--	--	--

	Sedimentary interbed FG-G			Sedimentary interbed F-G			Basalt flow group G		
Well	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base
77-1	--	--	--	4463	4	4459	4459	>42	<4417
78-4	--	--	--	--	--	--	--	--	--
87	--	--	--	4466	10	4456	4456	40	4416
88	--	--	--	4503	6	4497	4497	97	4400
89	4460	14	4446	--	--	--	4446	>63	<4383
90	--	--	--	4432	12	4420	4420	>36	<4384
94	--	--	--	--	--	--	--	--	--
117	--	--	--	4487	12	4475	4475	89	4386
118	--	--	--	4446	>3	<4443	--	--	--
119	--	--	--	4460	9	4451	4451	>3	<4448
120	--	--	--	4525	6	4519	4519	123	4396
RWMC	--	--	--	4441	15	4426	4426	58	4368

Table 4. Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled prior to 1989 (from Anderson and Lewis, 1989). (cont).

	Sedimentary interbed G-H			Basalt flow group H			Sedimentary interbed H-I		
Well	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base	Altitude of top	Thickness	Altitude of base
77-1	--	--	--	--	--	--	--	--	--
78-4	--	--	--	--	--	--	--	--	--
87	4416	5	4411	4411	15	4396	4396	>20	<4376
88	4400	>15	<4385	--	--	--	--	--	--
89	--	--	--	--	--	--	--	--	--
90	--	--	--	--	--	--	--	--	--
94	--	--	--	--	--	--	--	--	--
117	4386	4	4382	4382	3	4379	4379	5	4374
118	--	--	--	--	--	--	--	--	--
119	--	--	--	--	--	--	--	--	--
120	4396	4	4392	4392	27	4365	4365	4	4361
RWMC	4368	5	4363	4363	25	4338	4338	6	4332

	Basalt flow group I		
Well	Altitude of top	Thickness	Altitude of base
77-1	--	--	--
78-4	--	--	--
87	--	--	--
88	--	--	--
89	--	--	--
90	--	--	--
94	--	--	--
117	4374	>16	<4358
118	--	--	--
119	--	--	<4327
120	4361	>49	<4312
RWMC	4332	>12	<4320

Table 5: Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled after 1989.

Well	Surficial Sediment Thickness	Base Elevation of Sediment	Top Elevation of Flow Group A	Thickness of Flow Group A	Base Elevation of Flow Group A	Top Elevation of A-B Interbed	Thickness of A-B Interbed	Base Elevation of A-B Interbed
M1Sa	4	5007	5007	28	4979	4979	4	4975
M3S	3	5013	5013	27	4986	4986	5	4981
M4D	5	5018	-	0	-	-	0	-
M6S	3	5062	-	0	-	-	0	-
M7S	6	4999	-	0	-	-	0	-
M10S	2	5019	-	0	-	-	0	-
OCVZ-1	4	5007	5007	29	4978	4978	3	4975
OCVZ-3A	4	5011	5011	28	4983	4983	3	4980
OCVZ-4	2	5020	-	0	-	-	0	-
OCVZ-6	2	5064	-	0	-	-	0	-
OCVZ-7	3	5001	-	0	-	-	0	-
OCVZ-10	1	5020	-	0	-	-	0	-
1E	15	4995	-	0	-	-	0	-
1V	9	5002	-	0	-	-	0	-
2E	17	4994	4994	17	4977	4977	8	4969
2V	7	5003	5003	13	4989	4989	4	4985
3E	6	5008	-	0	-	-	0	-
3V	15	4997	-	0	-	-	0	-
4E	23	4994	-	0	-	-	0	-
4V	13	5002	-	0	-	-	0	-
5E	21	4995	-	0	-	-	0	-
5V	22	4992	-	0	-	-	0	-
6V	10	5007	5007	20	4987	4987	8	4979
7V	16	4997	4997	17	4980	4980	2	4978
8V	21	4995	-	0	-	-	0	-
9V	22	4996	-	0	-	-	0	-
10V	10	5006	5006	15	4991	4991	6	4985

Table 5: Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled after 1989 (cont).

Well	Top Elevation of Flow Group B	Thickness of Flow Group B	Base Elevation of Flow Group B	Top Elevation of B-C Interbed	Thickness of B-C Interbed	Base Elevation of B-C Interbed
M1SA	4975	59	4916	4916	20	4896
M3S	4981	64	4907	4907	12	4895
M4D	5018	105	4913	4913	25	4888
M6S	5062	163	4899	4899	10	4889
M7S	4999	91	4908	4908	6	4902
M10S	5019	110	4909	4909	24	4885
OCVZ-1	4975	59	4916	4916	19	4897
OCVZ-3A	4980	72	4908	4908	13	4895
OCVZ-4	5020	108	4912	4912	24	4888
OCVZ-6	5064	164	4900	4900	13	4887
OCVZ-7	5001	94	4907	4907	6	4901
OCVZ-10	5020	113	4907	4907	21	4886
1E	4995	85	4910	4910	8	4902
1V	5002	88	4914	4914	8	4906
2E	4969	55	4914	4914	3	4911
2V	4985	73	4912	4912	7	4905
3E	5008	93	4915	4915	2	4913
3V	4997	86	4911	4911	2	4909
4E	4994	79	4915	4915	3	4912
4V	5002	92	4910	4919	15	4905
5E	4995	76	4919	4919	7	4912
5V	4992	78	4915	4915	4	4911
6V	4979	54	4925	4925	3	4922
7V	4978	53	4925	4925	3	4922
8V	4995	84	4911	4911	32	4879
9V	4996	82	4914	4914	22	4892
10V	4985	67	4918	4918	22	4896

Table 5: Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled after 1989 (cont).

Well	Top Elevation of Flow Group C	Thickness of Flow Group C	Base Elevation of Flow Group C	Top Elevation of C2-C3 Interbed	Thickness of C2-C3 Interbed	Base Elevation of C2-C3 Interbed
M1SA	4896	106	4790	-	0	-
M3S	4895	103	4792	-	0	-
M4D	4888	101	4787	-	0	-
M6S	4889	109	4780	4780	4	4776
M7S	4902	168	4734	-	0	-
M10S	4885	96	4789	-	0	-
OCVZ-1	4897	107	4790	-	0	-
OCVZ-3A	4895	104	4791	-	0	-
OCVZ-4	4888	101	4787	-	0	-
OCVZ-6	4887	142	4745	-	0	-
OCVZ-7	4901	119	4782	-	0	-
OCVZ-10	4886	105	4781	-	0	-
1V	4906	>3	< 4903.14	-	-	-
2E	4911	>1	< 4909.58	-	-	-
2V	4905	134	4771	-	0	-
3E	4913	> 23	< 4890.49	-	-	-
3V	4909	120	4789	-	0	-
4E	4912	> 1	< 4911.08	-	-	-
4V	4905	113	4792	-	0	-
5V	4911	> 75	< 4835.67	-	-	-
6V	4922	129	4793	-	0	-
7V	4922	133	4789	-	0	-
8V	4879	90	4789	-	0	-
9V	4892	99	4793	-	0	-
10V	4896	103	4793	-	0	-

Table 5: Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled after 1989 (cont).

Well	Top Elevation of Flow Group C3	Thickness of Flow Group C3	Base Elevation of Flow Group C3	Top Elevation of C-D Interbed	Thickness of C-D Interbed	Base Elevation of C-D Interbed
M1SA	-	0	-	4790	20	4770
M3S	-	0	-	4792	4	4788
M4D	-	0	-	4787	25	4762
M6S	4776	31	4745	4745	19	4726
M7S	-	0	-	4734	5	4729
M10S	-	0	-	4789	28	4761
OCVZ-1	-	0	-	4790	20	4770
OCVZ-3A	-	0	-	4791	4	4787
OCVZ-4	-	0	-	4787	25	4762
OCVZ-6	-	0	-	4745	> 2	< 4743
OCVZ-7	-	0	-	4782	3	4779
OCVZ-10	-	0	-	4781	20	4761
2V	-	0	-	4771	5	4766
3V	-	0	-	4789	5	4784
4V	-	0	-	4792	5	4787
6V	-	0	-	4793	6	4787
7V	-	0	-	4789	8	4781
8V	-	0	-	4789	3	4786
9V	-	0	-	4793	3	4790
10V	-	0	-	4793	9	4784

Table 5: Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled after 1989 (cont).

Well	Top Elevation of Flow Group D	Thickness of Flow Group D	Base Elevation of Flow Group D	Top Elevation of D-E Interbed	Thickness of D-E Interbed	Base Elevation of D-E Interbed
M1SA	4770	25	4745	4745	5	4740
M3S	4788	88	4700	4700	2	4698
M4D	4762	14	4748	4748	16	4732
M6S	4726	48	4678	4678	5	4673
M7S	4729	52	4677	4677	3	4674
M10S	4761	24	4737	4737	12	4725
OCVZ-1	4770	> 7	< 4762	-	0	-
OCVZ-3A	4787	> 5	< 4782	-	0	-
OCVZ-4	4762	> 15	< 4747	-	0	-
OCVZ-7	4779	> 16	< 4763	-	0	-
OCVZ-10	4761	> 5	< 4756	-	0	-

Well	Top Elevation of Flow Group E	Thickness of Flow Group E	Base Elevation of Flow Group E	Top Elevation of E-F Interbed	Thickness of E-F Interbed	Base Elevation of E-F Interbed
M1SA	4740	86	4654	4654	5	4649
M3S	4698	86	4612	-	0	-
M4D	4732	94	4638	-	0	-
M6S	4673	42	4631	-	0	-
M7S	4674	69	4605	-	0	-
M10S	4725	94	4631	-	0	-

Table 5: Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled after 1989 (cont).

Well	Top Elevation of Flow Group F	Thickness of Flow Group F	Base Elevation of Flow Group F	Top Elevation of F-FG Interbed	Thickness of F-FG Interbed	Base Elevation of F-FG Interbed
M1SA	4649	188	4461	4461	7	4454
M3S	4612	178	4434	-	0	-
M4D	4638	125	4513	-	0	-
M6S	4631	194	4437	-	0	-
M7S	4605	238	4367	-	0	-
M10S	4631	148	4483	-	0	-

Well	Top Elevation of Flow Group FG	Thickness of Flow Group FG	Base Elevation of Flow Group FG	Top Elevation of FG-G Interbed	Thickness of FG-G Interbed	Base Elevation of FG-G Interbed
M1SA	4454	4	4450	4450	6	4444
M3S	-	0	-	-	0	-
M4D	-	0	-	-	0	-
M6S	-	0	-	-	0	-
M7S	-	0	-	-	0	-
M10S	-	0	-	-	0	-

Well	Top Elevation of Interbed F-G	Thickness of Interbed F-G	Base Elevation of Interbed F-G	Top Elevation of Flow Group G	Thickness of Flow Group G	Base Elevation of Flow Group G
M1SA	-	0	-	4444	51	4393
M3S	4434	4	4430	4430	74	4356
M4D	4513	8	4505	4505	82	4423
M6S	4437	8	4429	4429	28	4401
M10S	4483	4	4479	4479	82	4397

Table 5: Thickness and altitude of top and base of basalt flows and sedimentary interbeds for wells drilled after 1989 (cont).

Well	Top Elevation of G-H Interbed	Thickness of G-H Interbed	Base Elevation of G-H Interbed	Top Elevation of Flow Group H	Thickness of Flow Group H	Base Elevation of Flow Group H
M1SA	-	0	-	-	0	-
M4D	-	0	-	-	0	-
M6S	4401	8	4393	4393	15	4378
M10S	4397	10	4387	4387	14	4373

Well	Top Elevation of G-I Interbed	Thickness of G-I Interbed	Base Elevation of G-I Interbed	Top Elevation of H-I Interbed	Thickness of Flow H-I Interbed	Base Elevation of H-I Interbed
M1SA	4393	5	4388	-	0	-
M4D	4423	2	4421	-	0	-
M6S	-	0	-	4378	9	4369
M10S	-	0	-	4373	12	4361

Well	Top Elevation of Flow Group H	Thickness of Flow Group H	Base Elevation of Flow Group H
M1SA	4388	55	4333
M4D	4369	236	4133
M10S	4361	18	4343

Table 6: Perched Water Monitoring Summary

Well name	Date Detected	Sample Depth	Region	Reference[b]
AP-4	1993	20 ft	surficial	3
MS-4	1993, 1994	10 ft	surficial	3,4
NAT-06	1991, 1994	10.5.	surficial	2,4
NAT-13	1994	16' 2"	surficial	4
NAT-16	1994	20' 2"	surficial	4
Pit 9-#3	1994	18 ft	surficial	4
Pit 9-#6	1993	7' 8"	surficial	3
77-2	1977, 1990	87 ft	110-ft interbed	1
78-1	1978, 1993, 1994	82 ft	110-ft interbed	1,3,4
8802D	1988-1994	221 ft	240-ft interbed	1,2,3,4
9302	1993, 1994	224	240-ft interbed	3,4
D10	1992-1994	203	240-ft interbed	2,3,4
USGS 92	1972-1994	214 ft	240-ft interbed	1,2,3,4
USGS 93	1973[a]	246	240-ft interbed	1
USGS 96	1972[a]	206	240-ft interbed	1

[a] These wells were cemented to land surface.

[b] References:

1. Hubbell(1990)
2. Hubbell (1992)
3. Hubbell (1993)
4. Hubbell (1994)

Appendix B

Figures

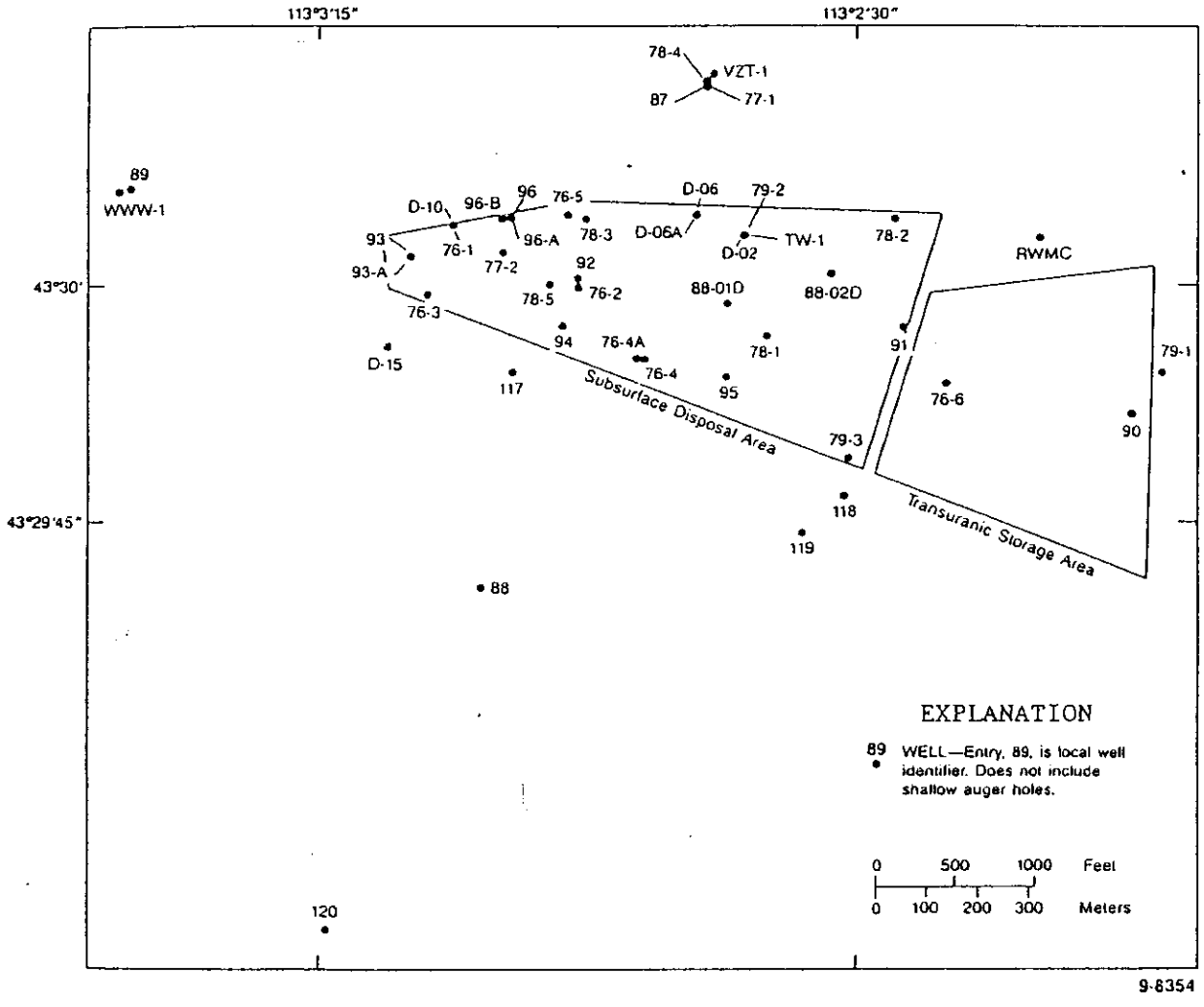

Figure 1. Locations of wells used in Anderson and Lewis (1989) to develop stratigraphic framework at RWMC (Anderson and Lewis, 1989).

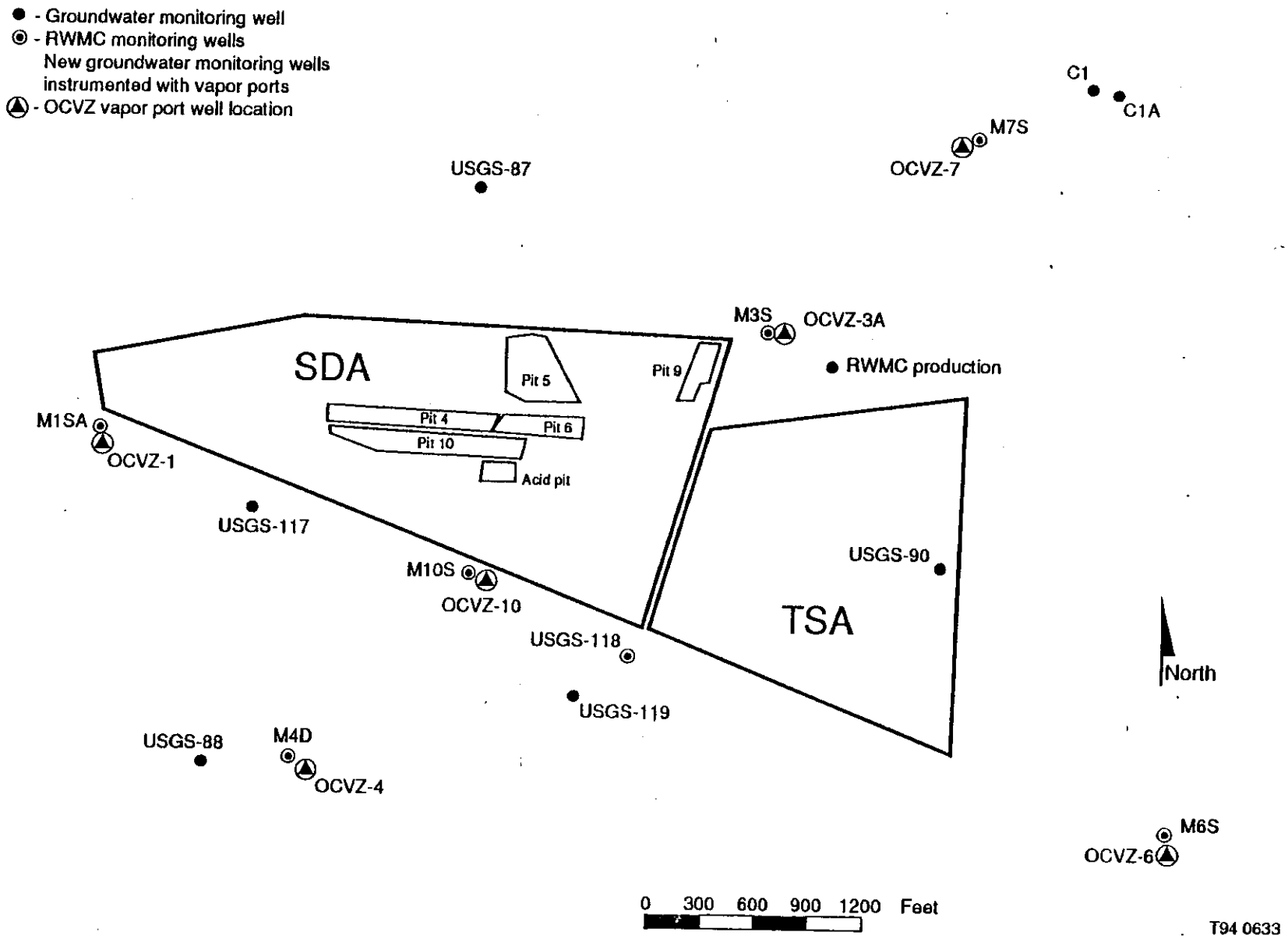

Figure 2. Locations of wells used in Burgess et al. (1994) (Burgess et al., 1994).

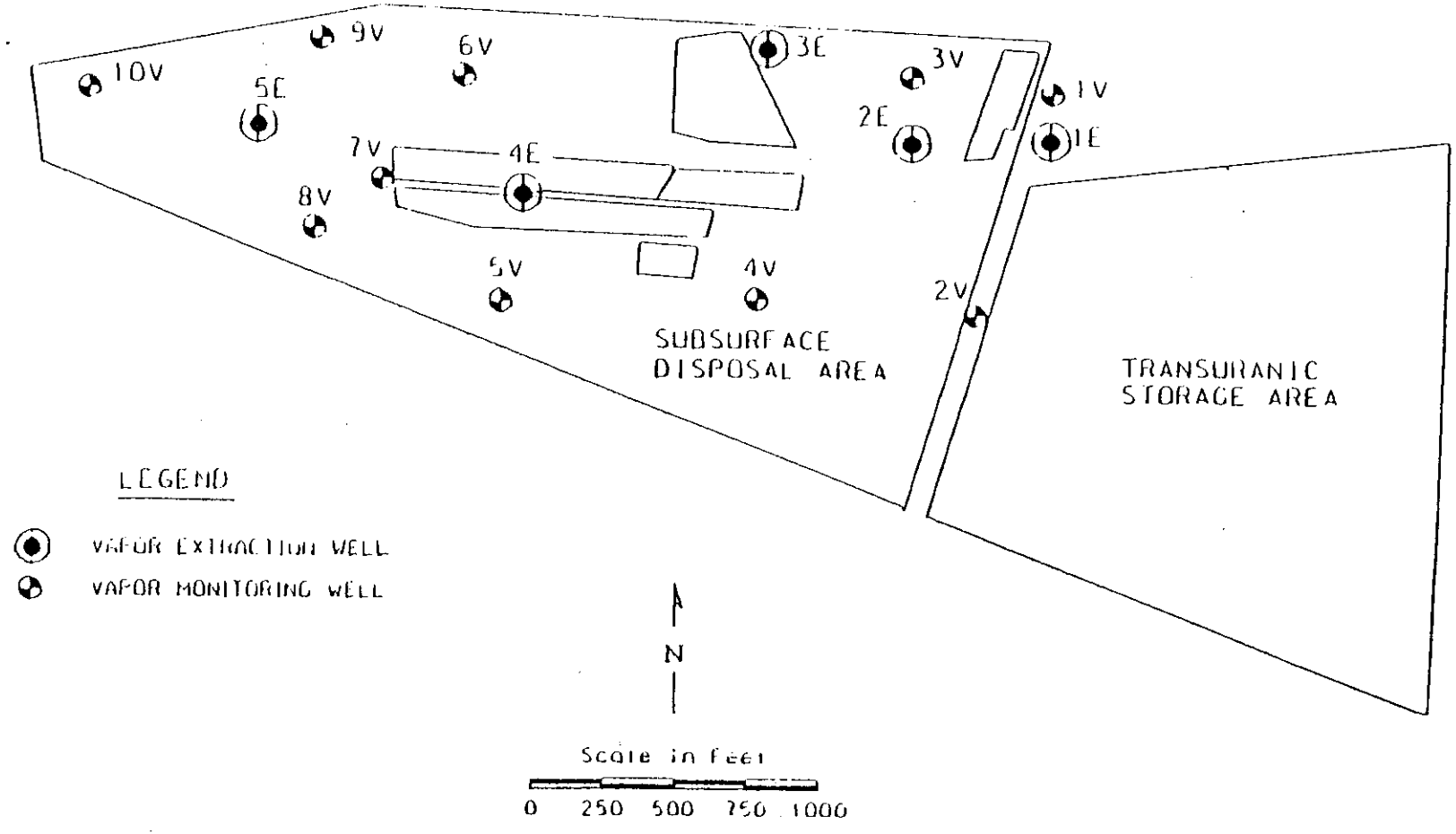

Figure 3. Locations of wells drilled at RWMC in 1994 (Parsons, 1995).

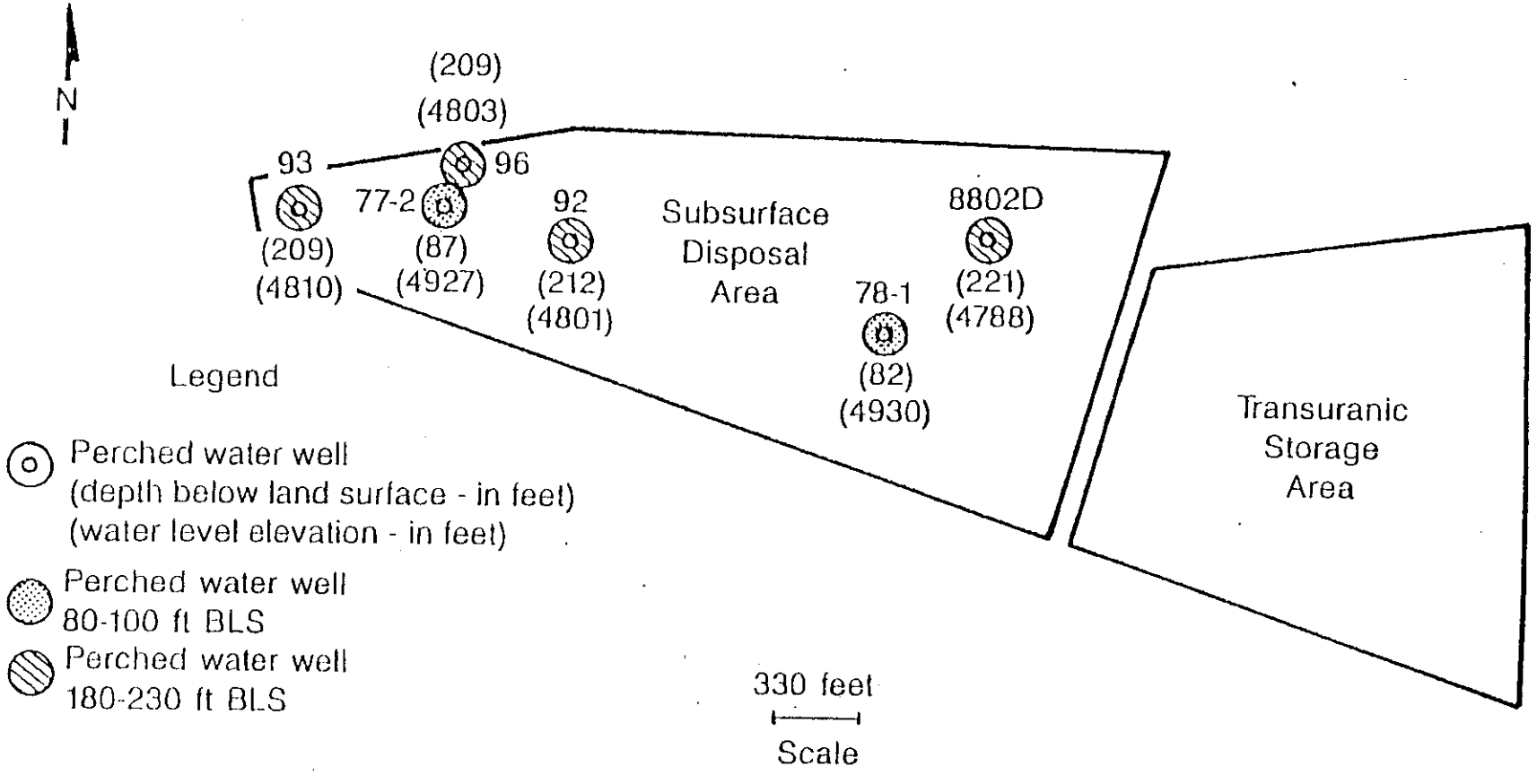

Figure 4. Locations of perched water wells used in Hubbell (1990) (Hubbell, 1990).

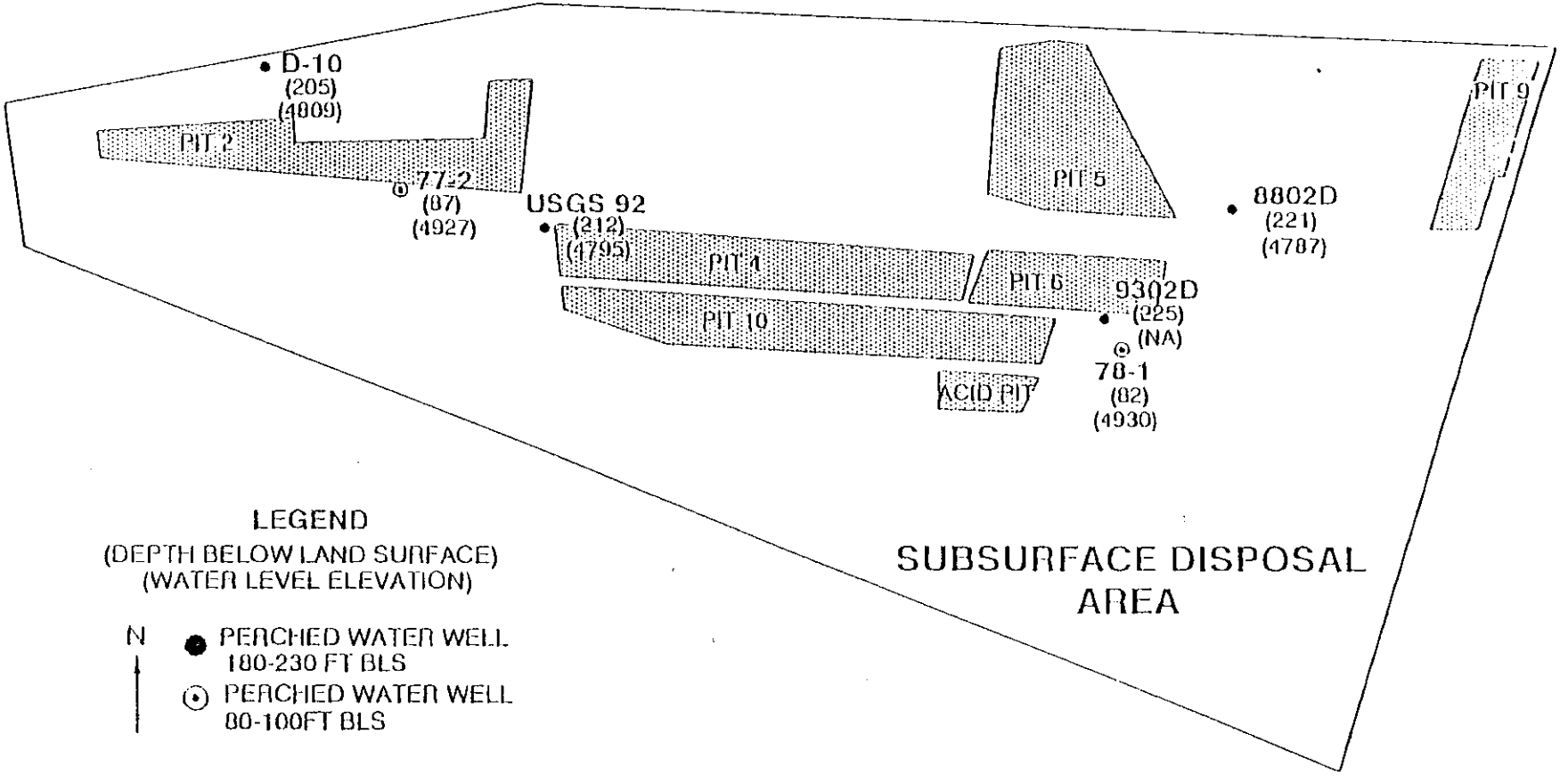

Figure 5. Locations of perched water wells used in Hubbell (1992) (Hubbell, 1992).

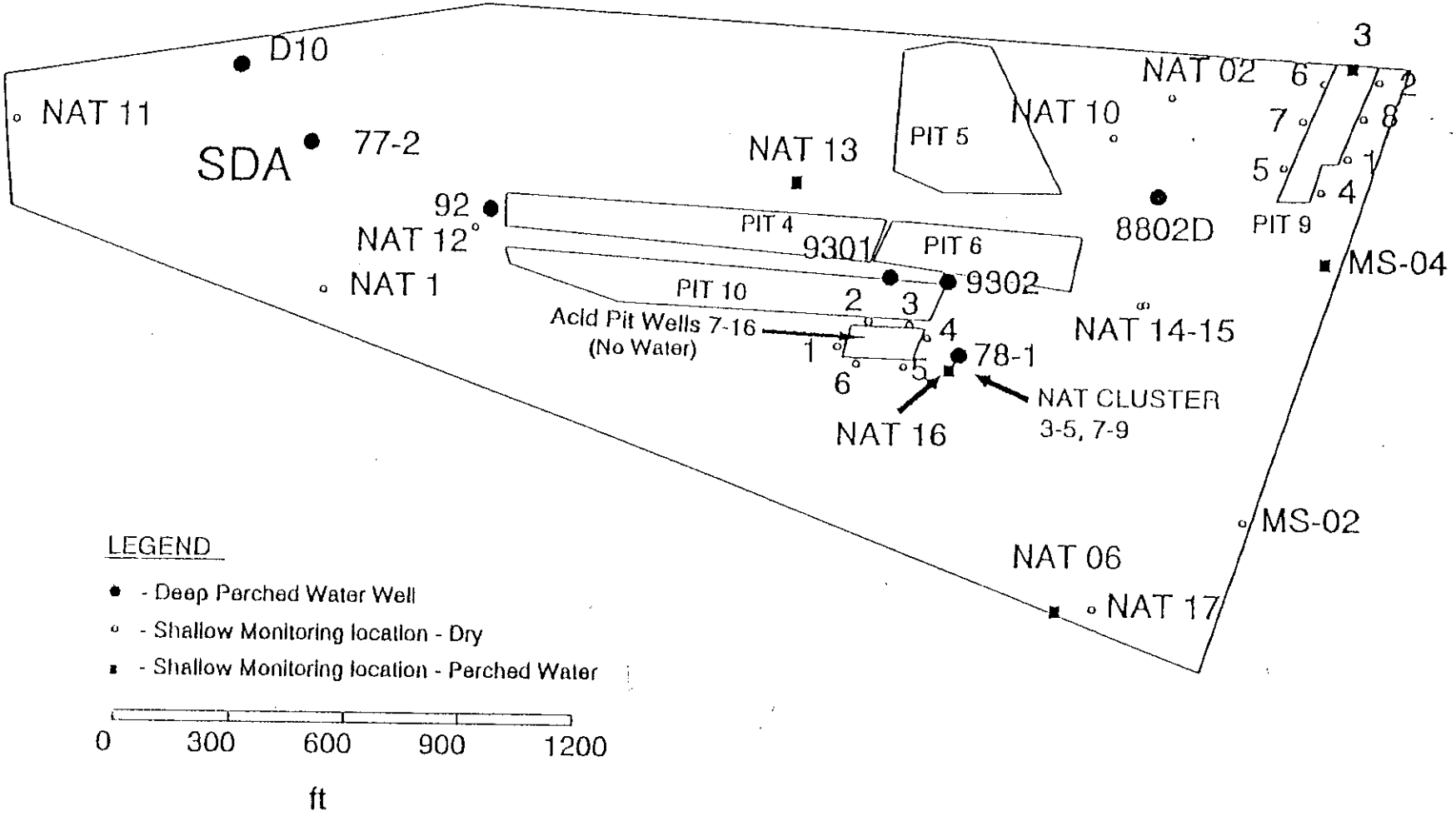

Figure 6. Locations of perched water wells used in Hubbell (1993) and Hubbell (1994) (Hubbell, 1994).

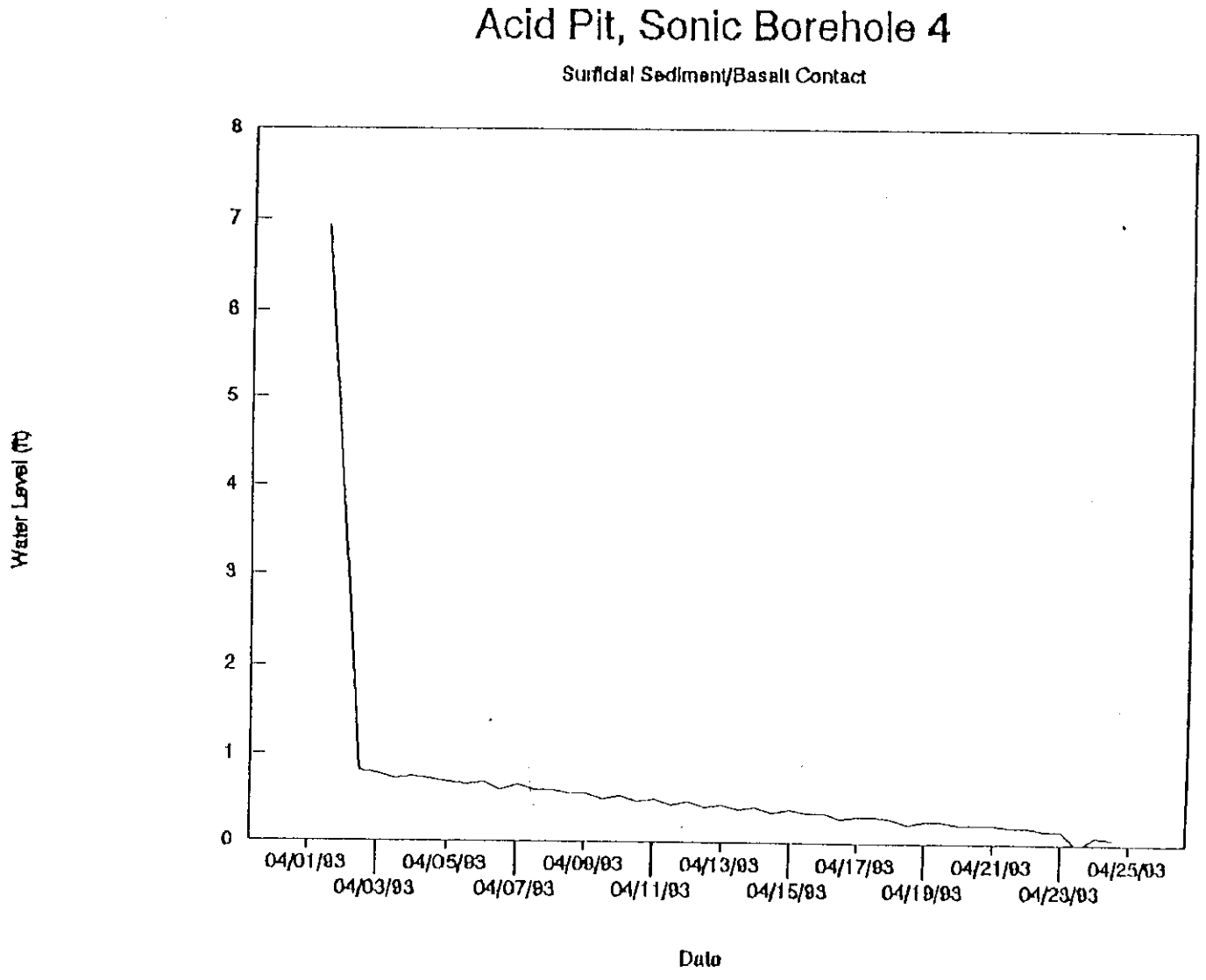

Figure 7. Water level in Acid Pit Borehole number 4, 1993 (Hubbell, 1993).

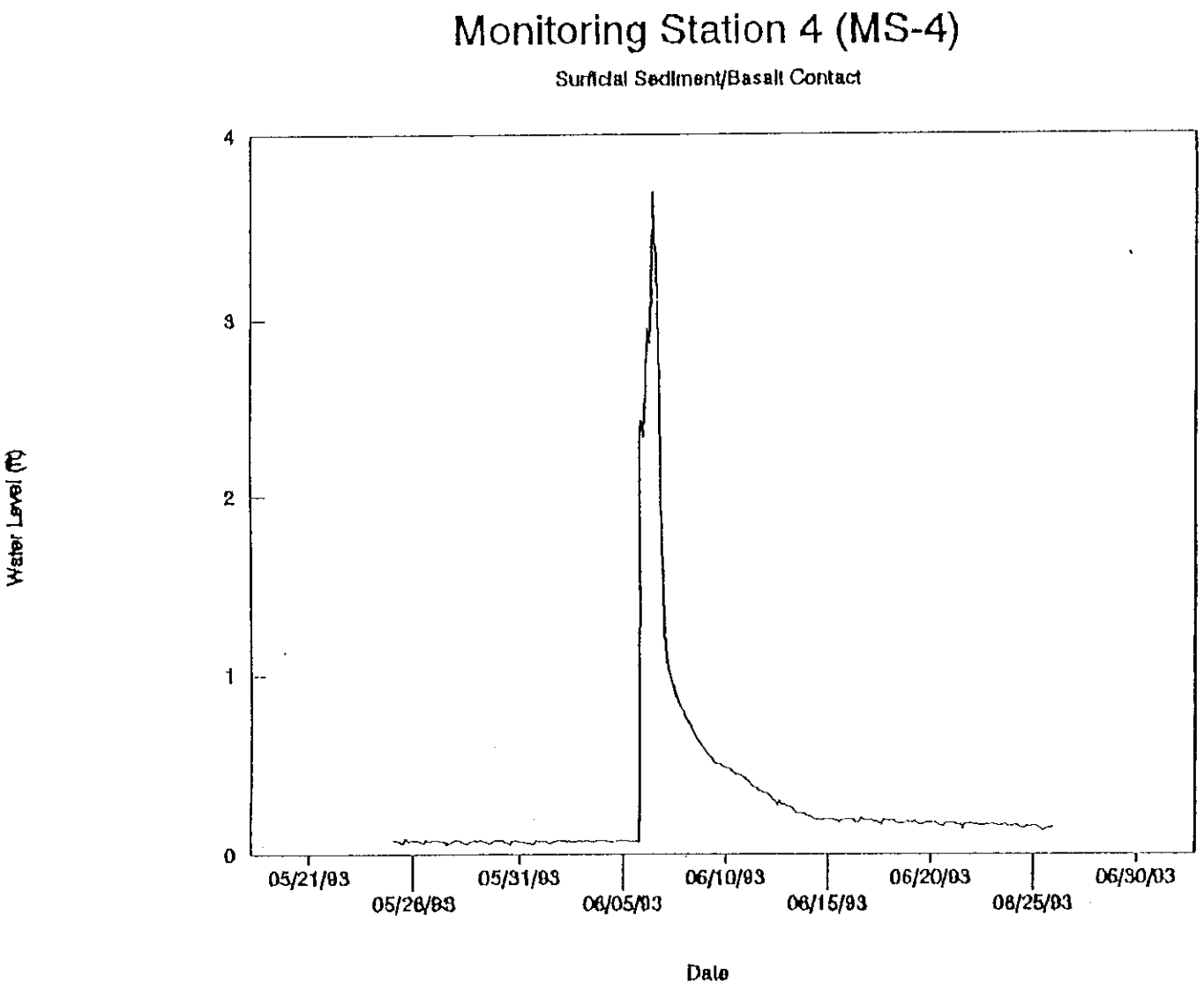

Figure 8. Water level in Monitoring Station MS-4, 1993 (Hubbell, 1993).

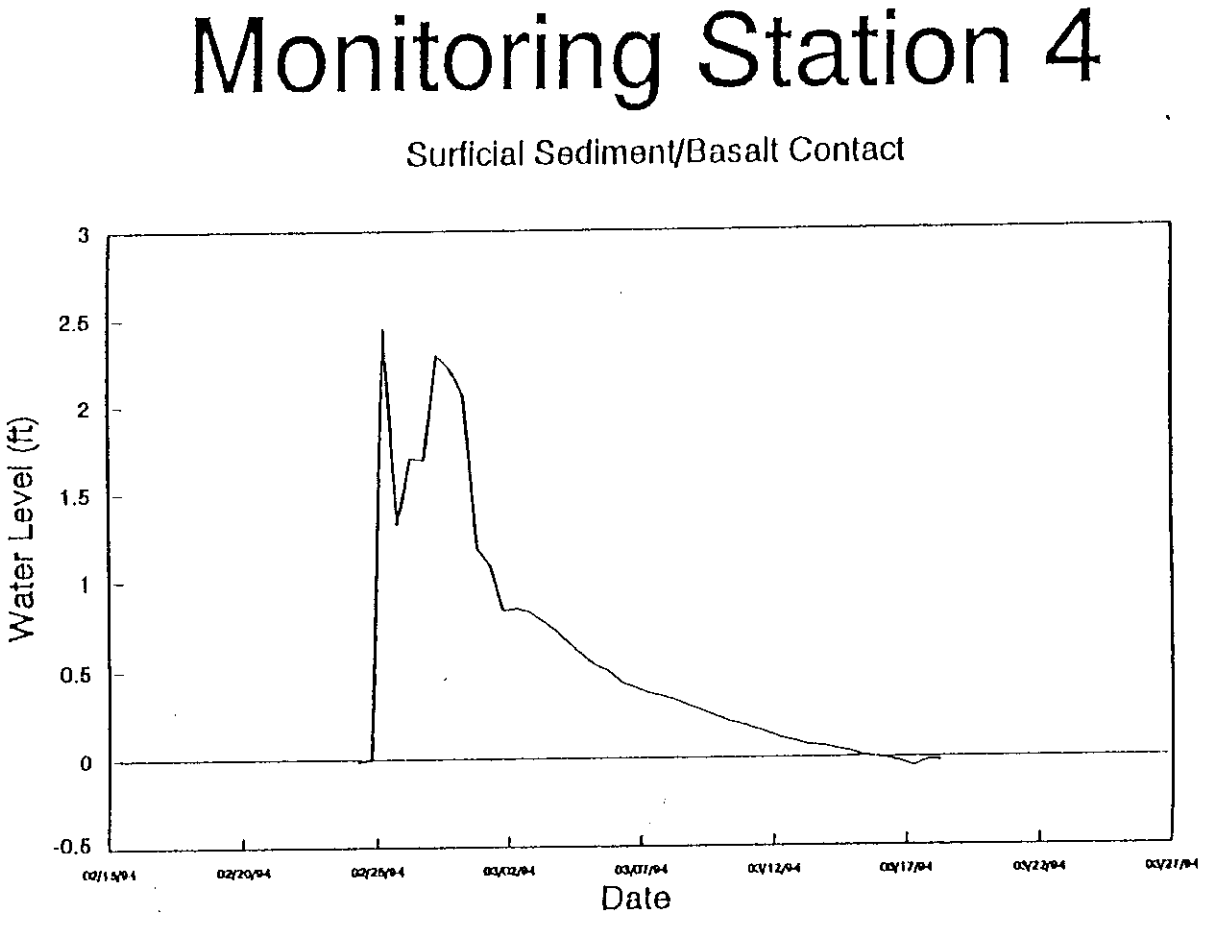

Figure 9. Water level in Monitoring Station MS-4, 1994 (Hubbell, 1994).

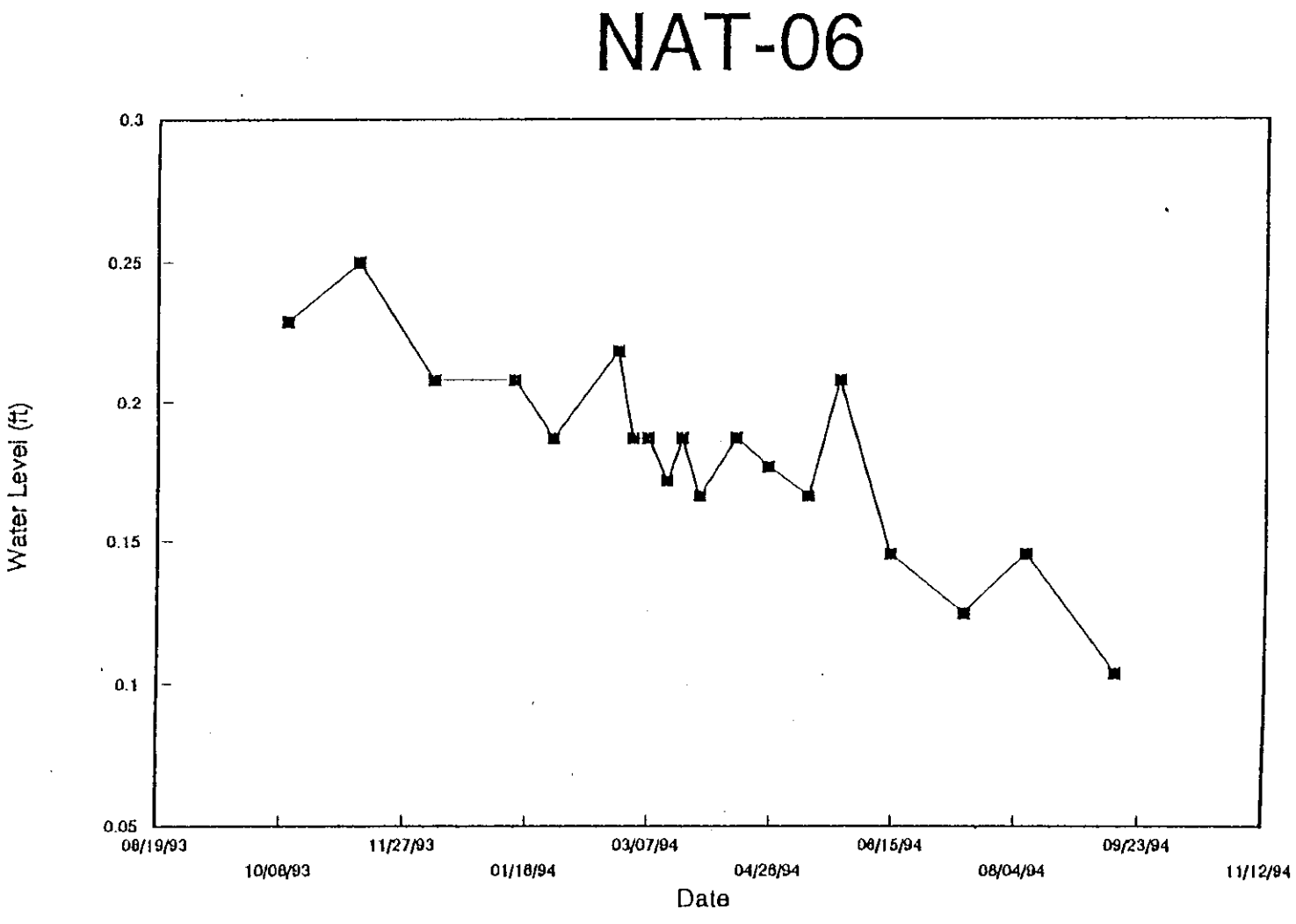

Figure 10. Water level in Neutron Access Tube NAT-06, 1993-94 (Hubbell, 1994).

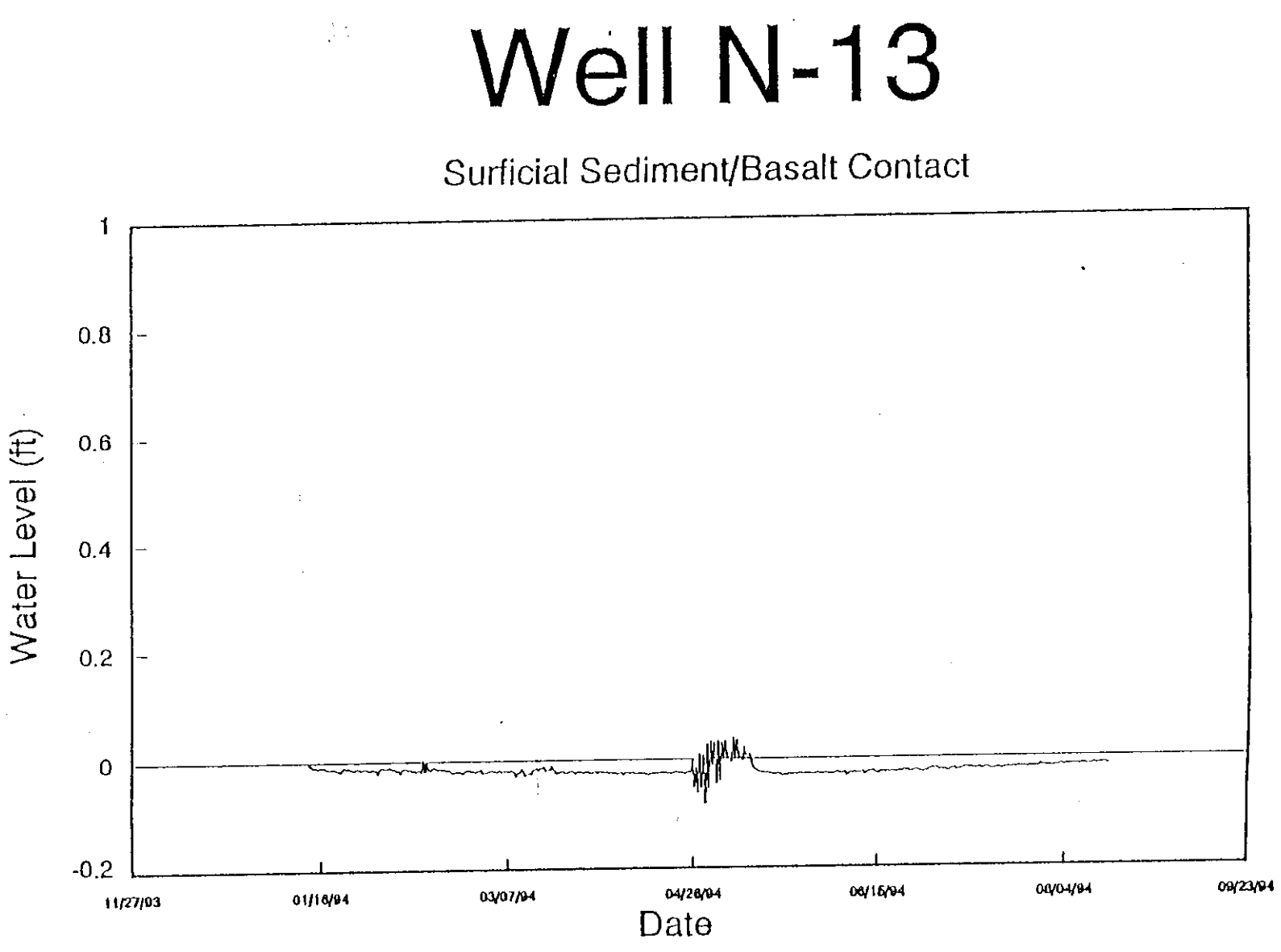

Figure 11. Water level in Neutron Access Tube NAT-13, 1994 (Hubbell, 1994).

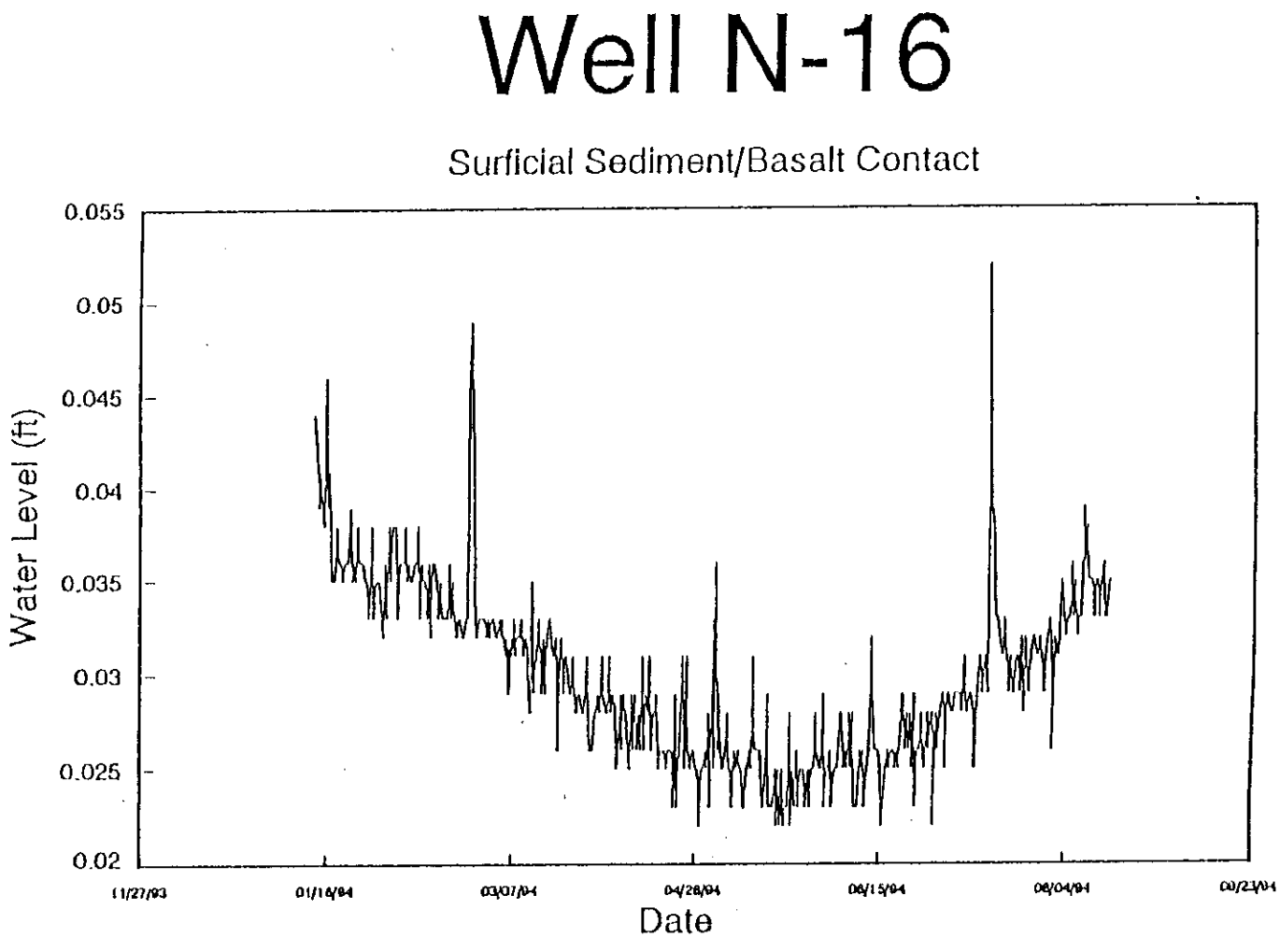

Figure 12. Water level in Neutron Access Tube NAT-16, 1994 (Hubbell, 1994).

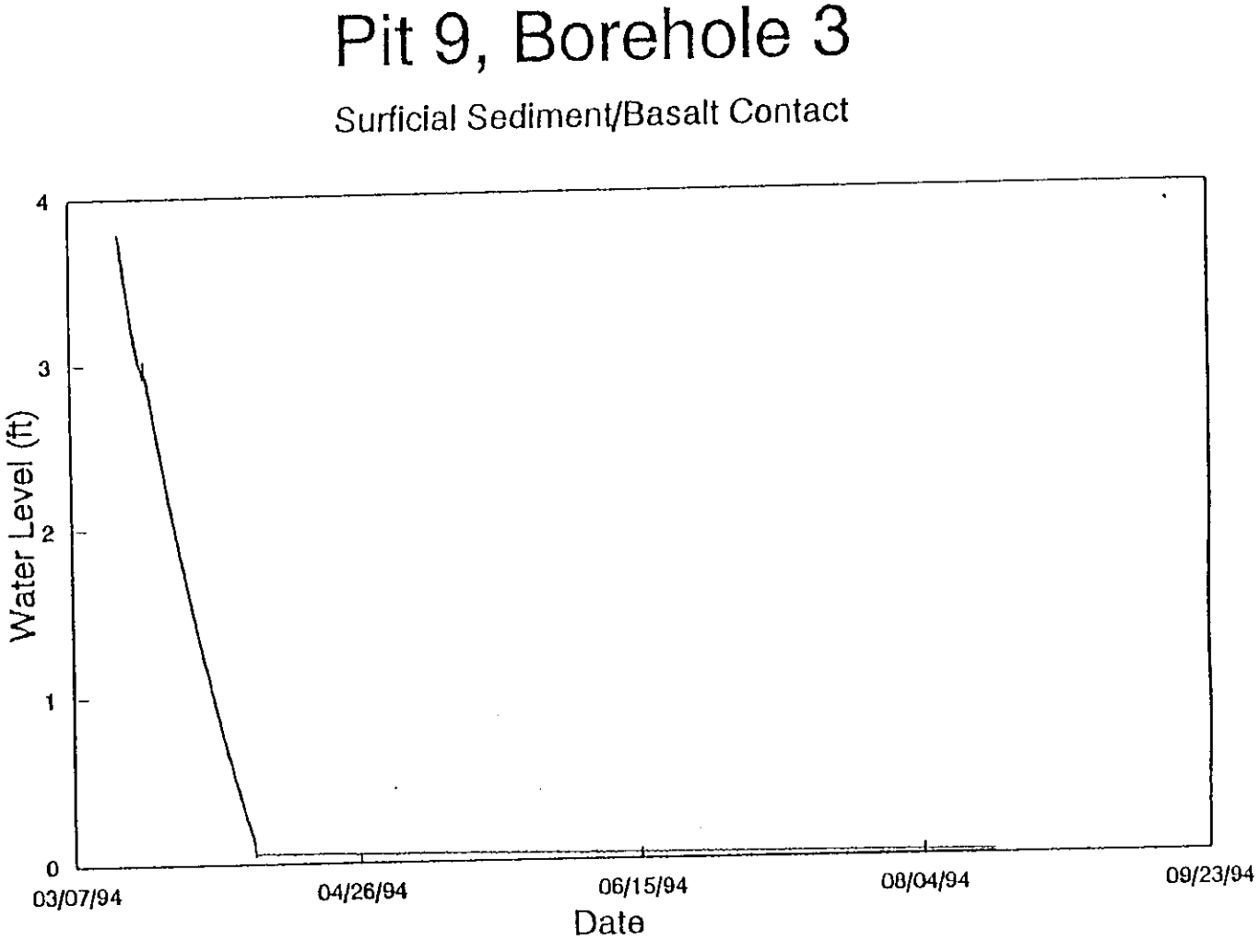

Figure 13. Water level in Pit 9 borehole number 3, 1994 (Hubbell, 1994).

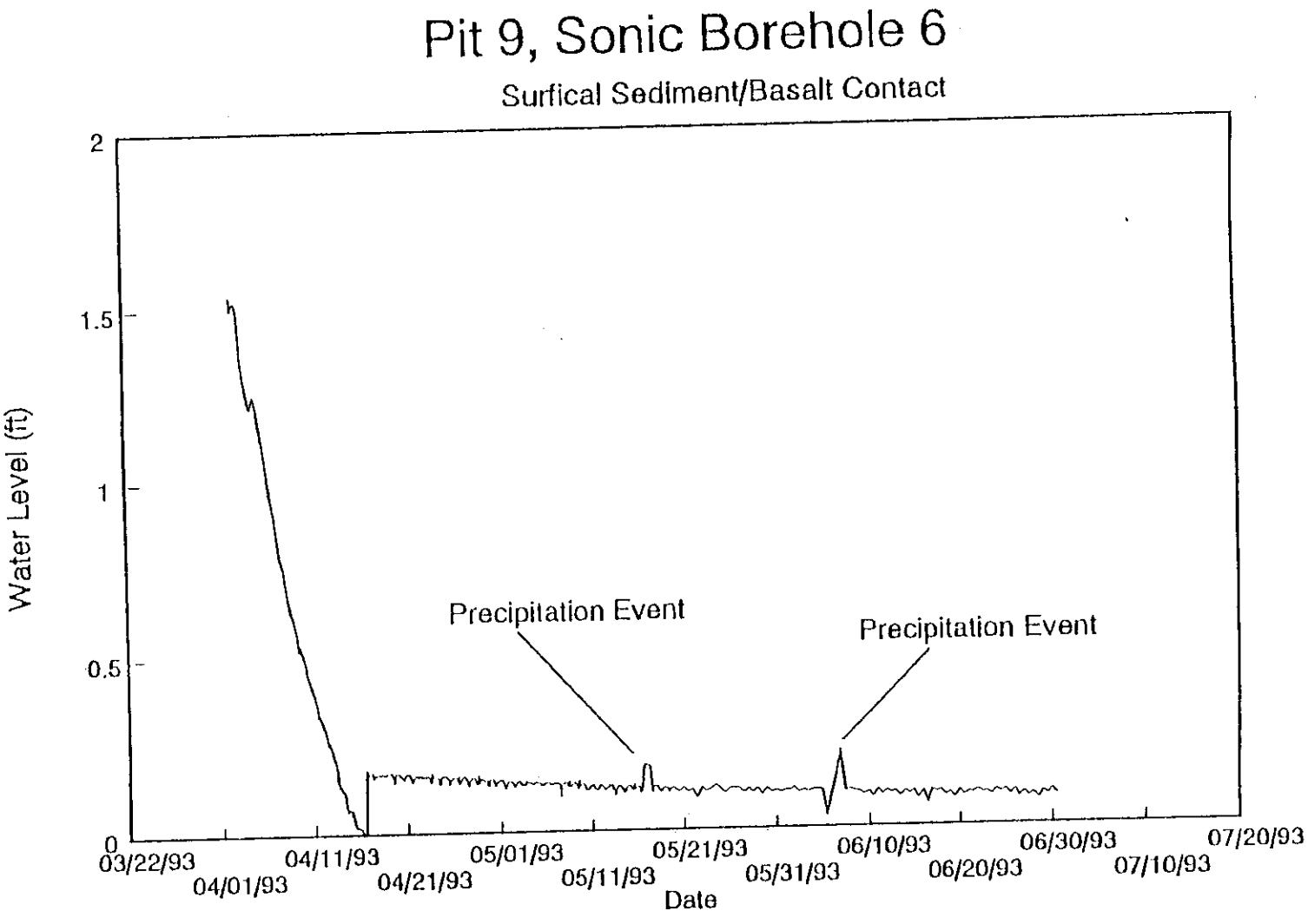

Figure 14. Water level in Pit 9 borehole number 6, 1993 (Hubbell, 1993).

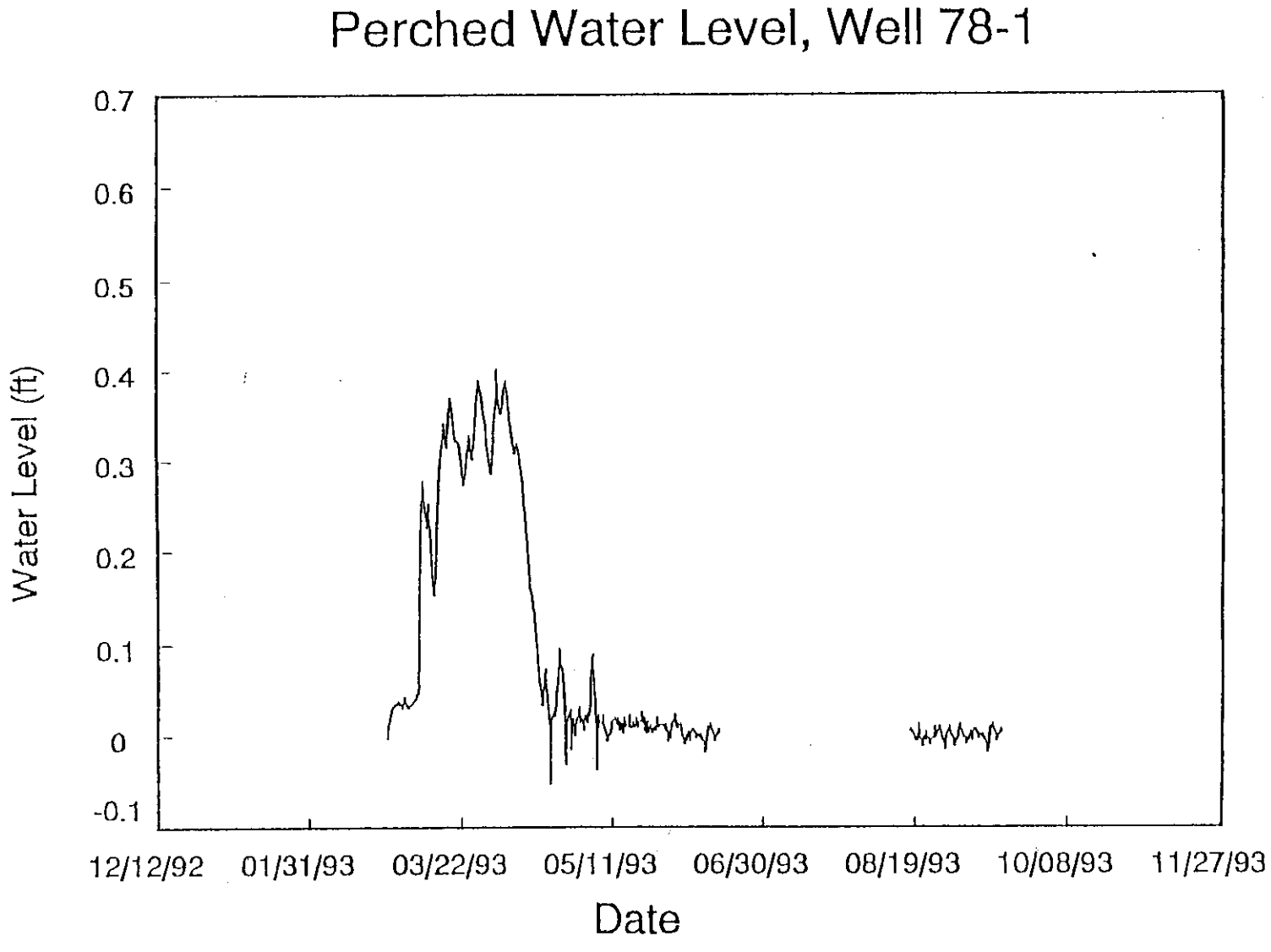

Figure 15. Water level in Well 78-1, 1993 (Hubbell, 1993).

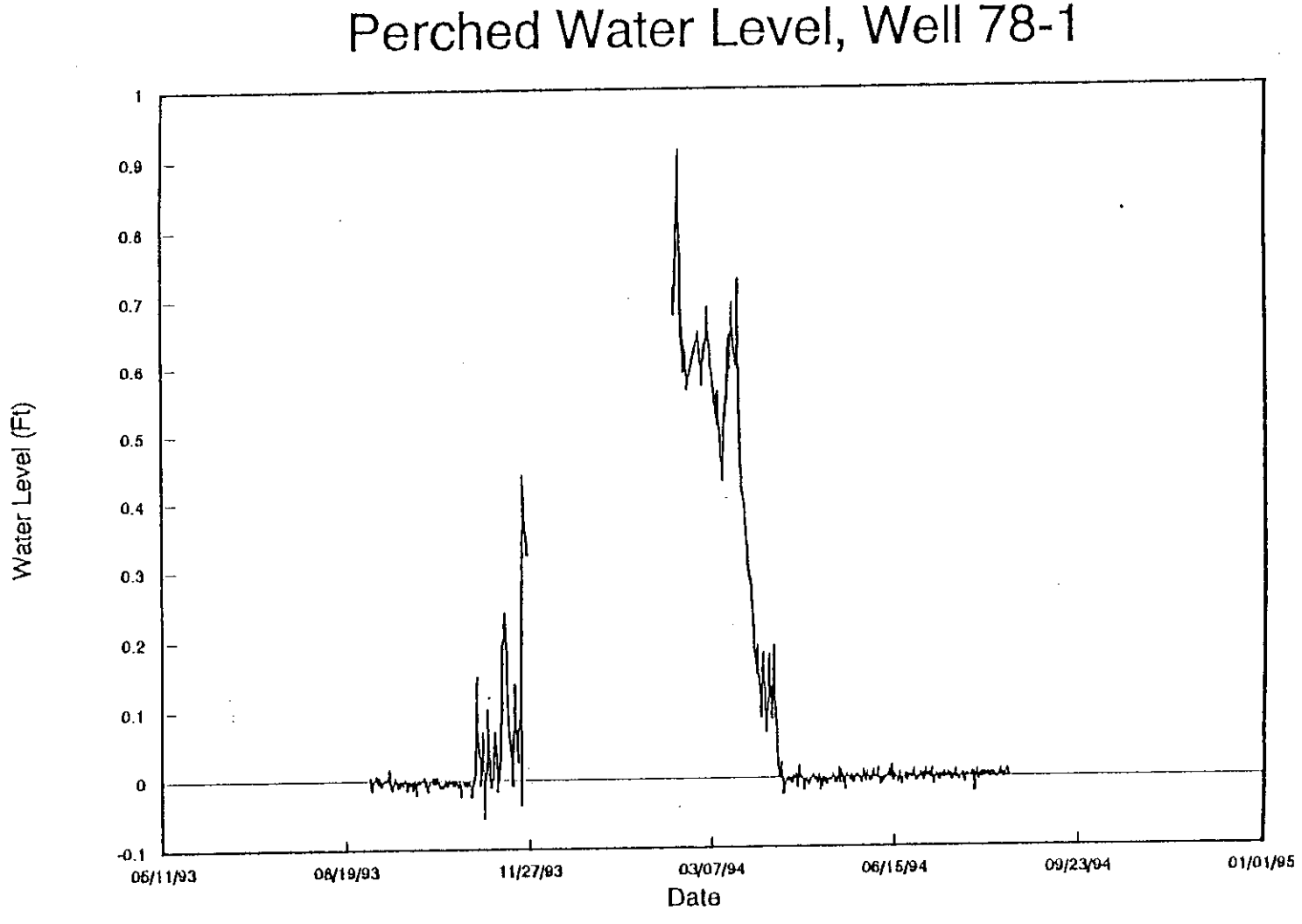

Figure 16. Water level in Well 78-1, 1993-94 (Hubbell, 1994).

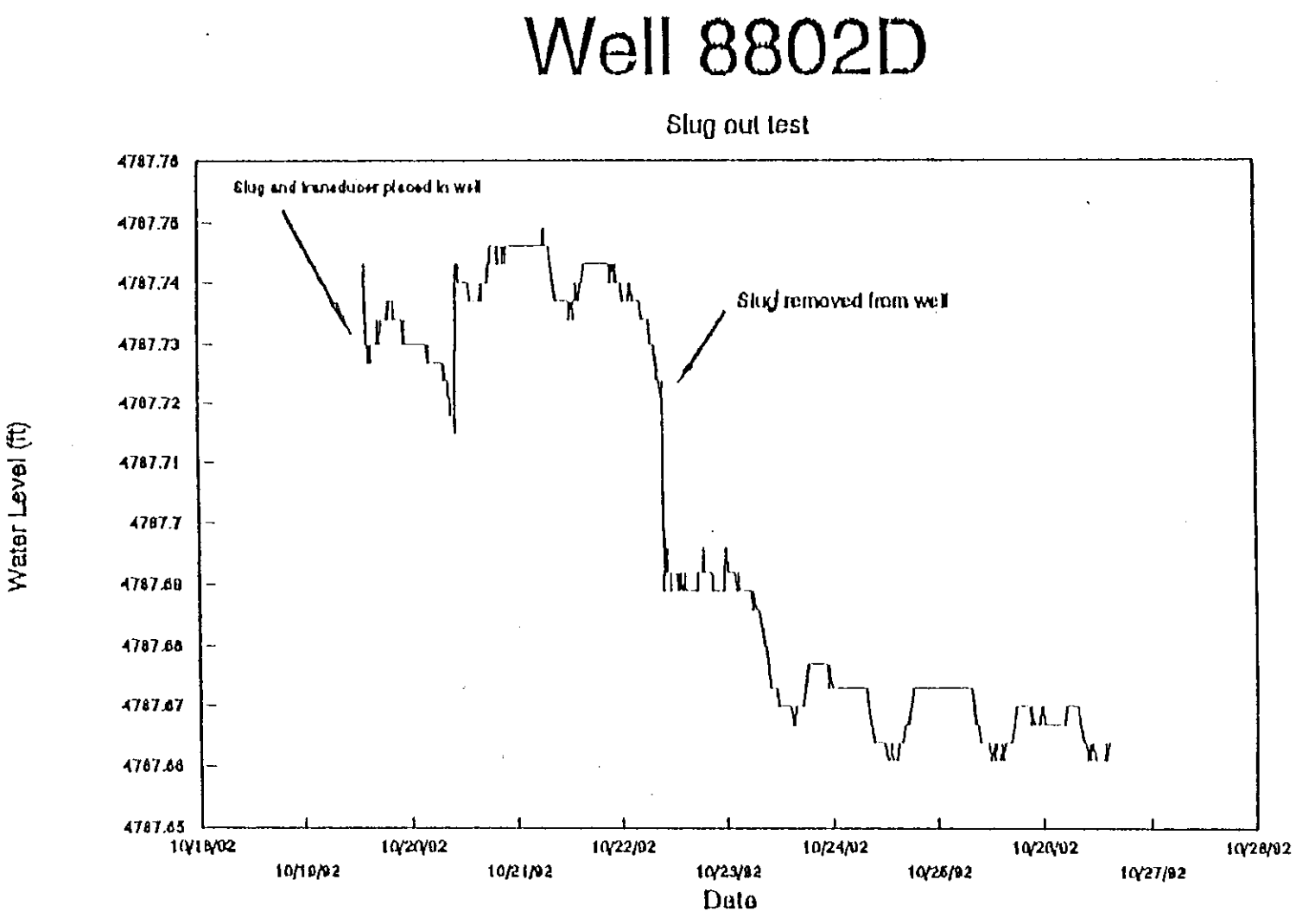

Figure 17. Water level in Well 8802D, 1992 (Hubbell, 1992).

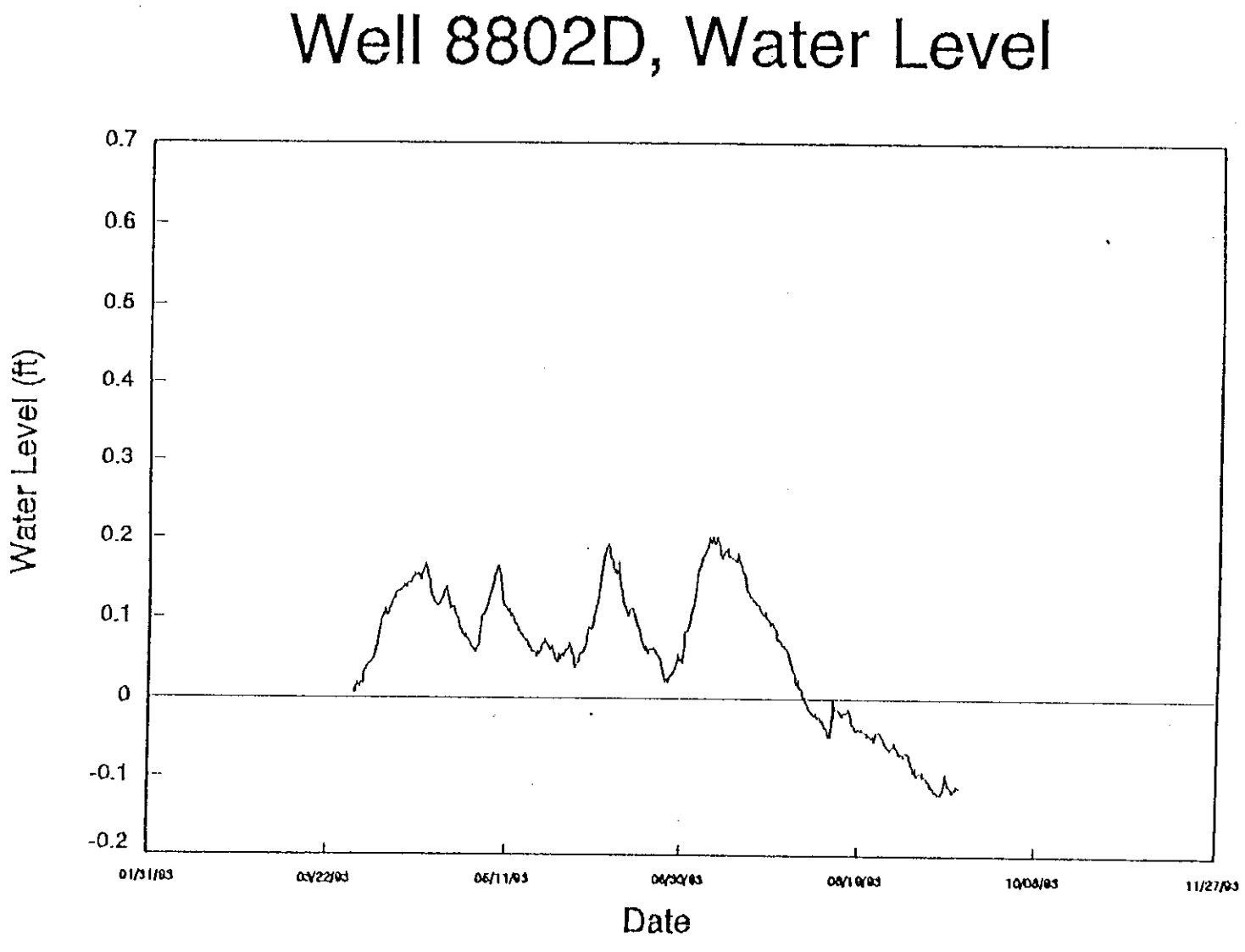

Figure 18. Water level in Well 8802D, 1993 (Hubbell, 1993).

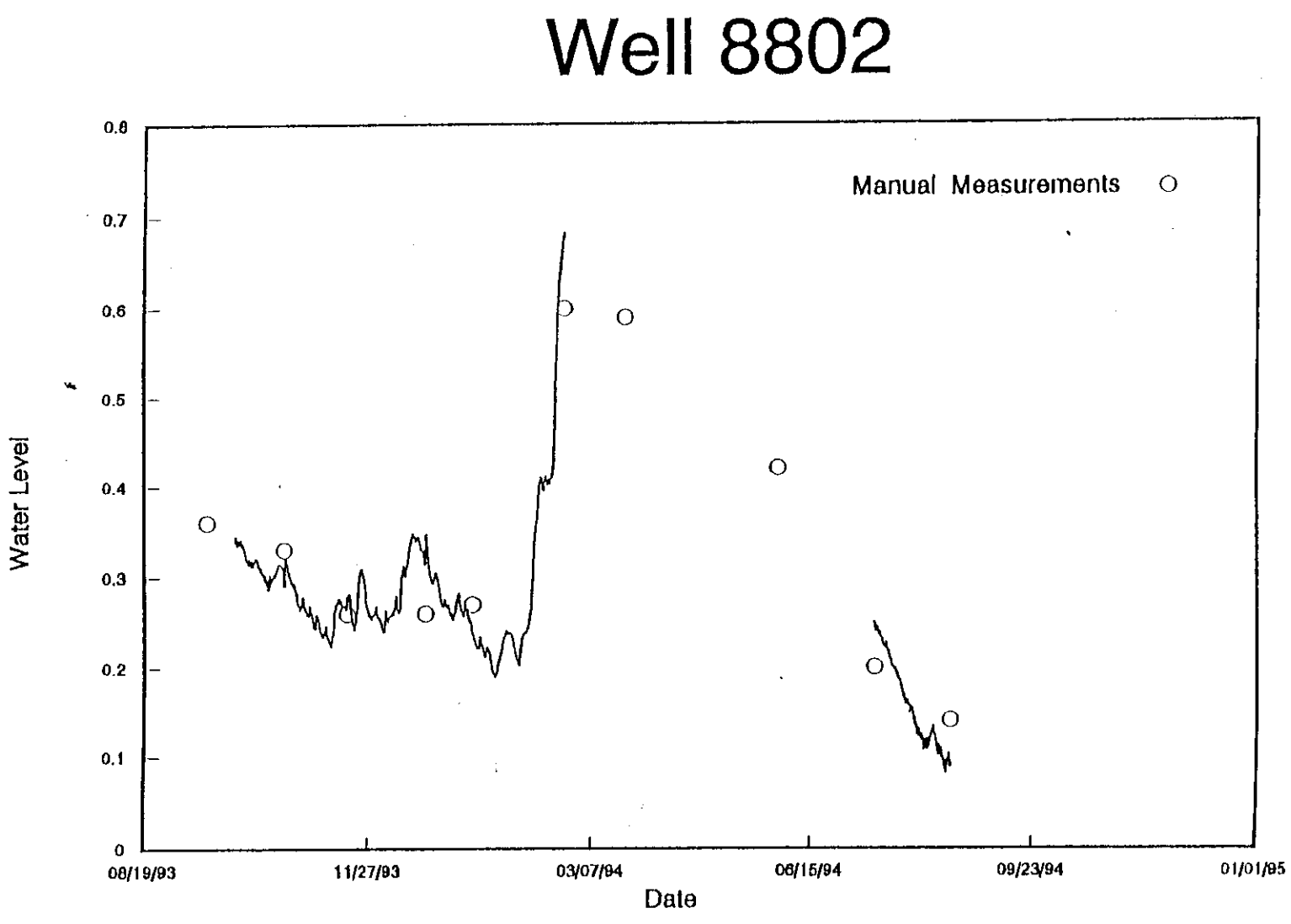

Figure 19. Water level in Well 8802D, 1993-94 (Hubbell, 1994).

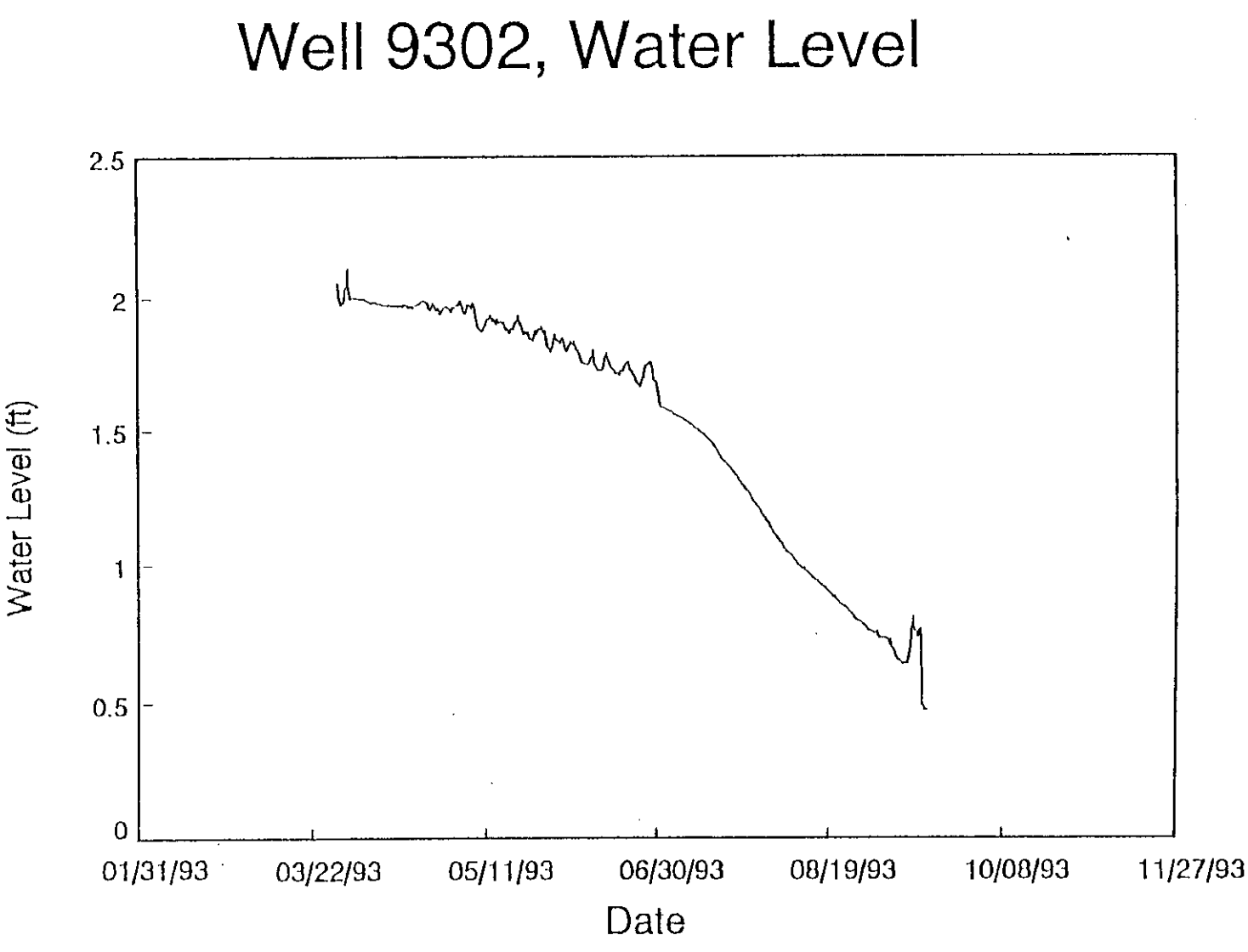

Figure 20. Water level in Well 9302, 1993 (Hubbell, 1993).

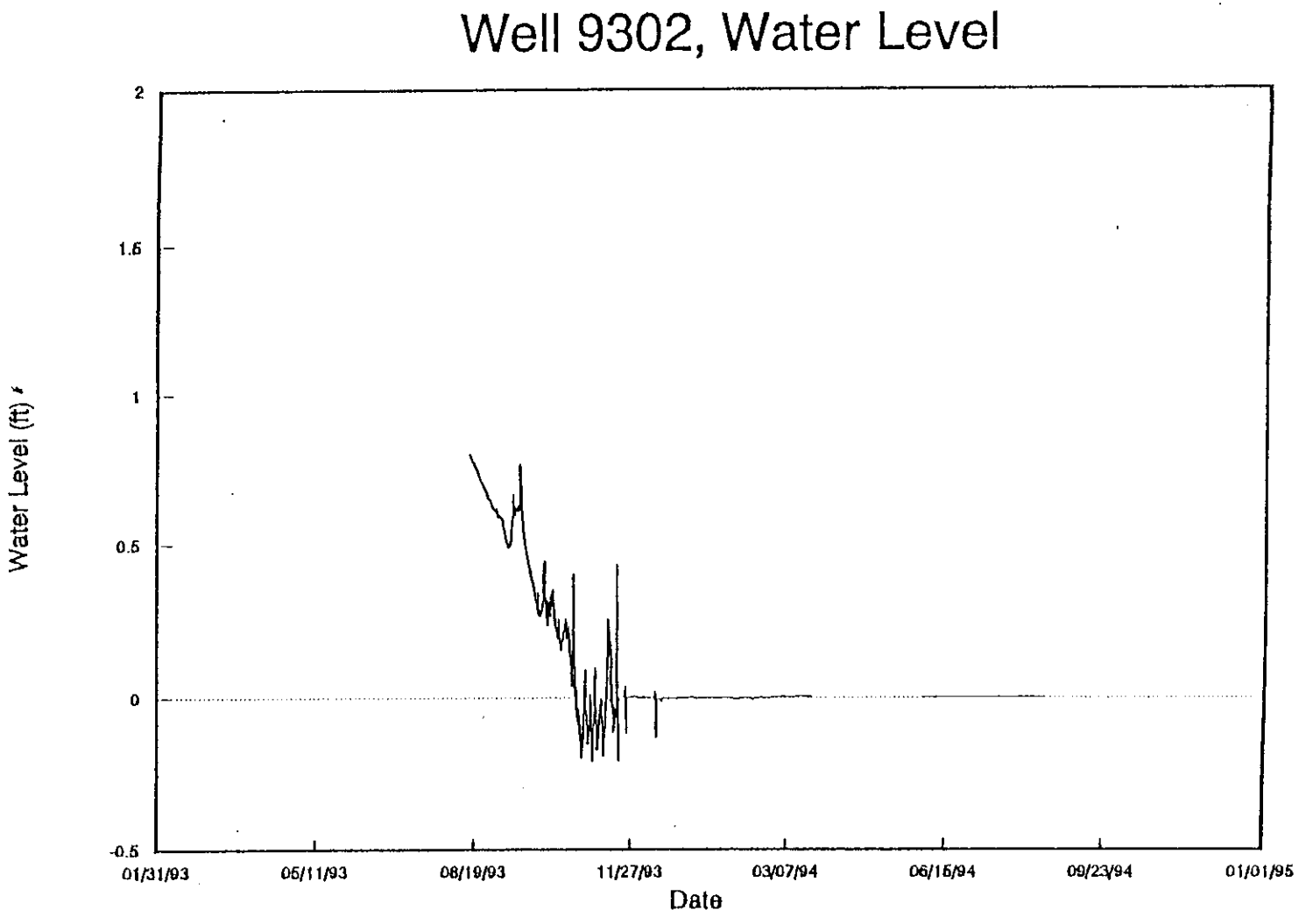

Figure 21. Water level in Well 9302, 1993-94 (Hubbell, 1994).

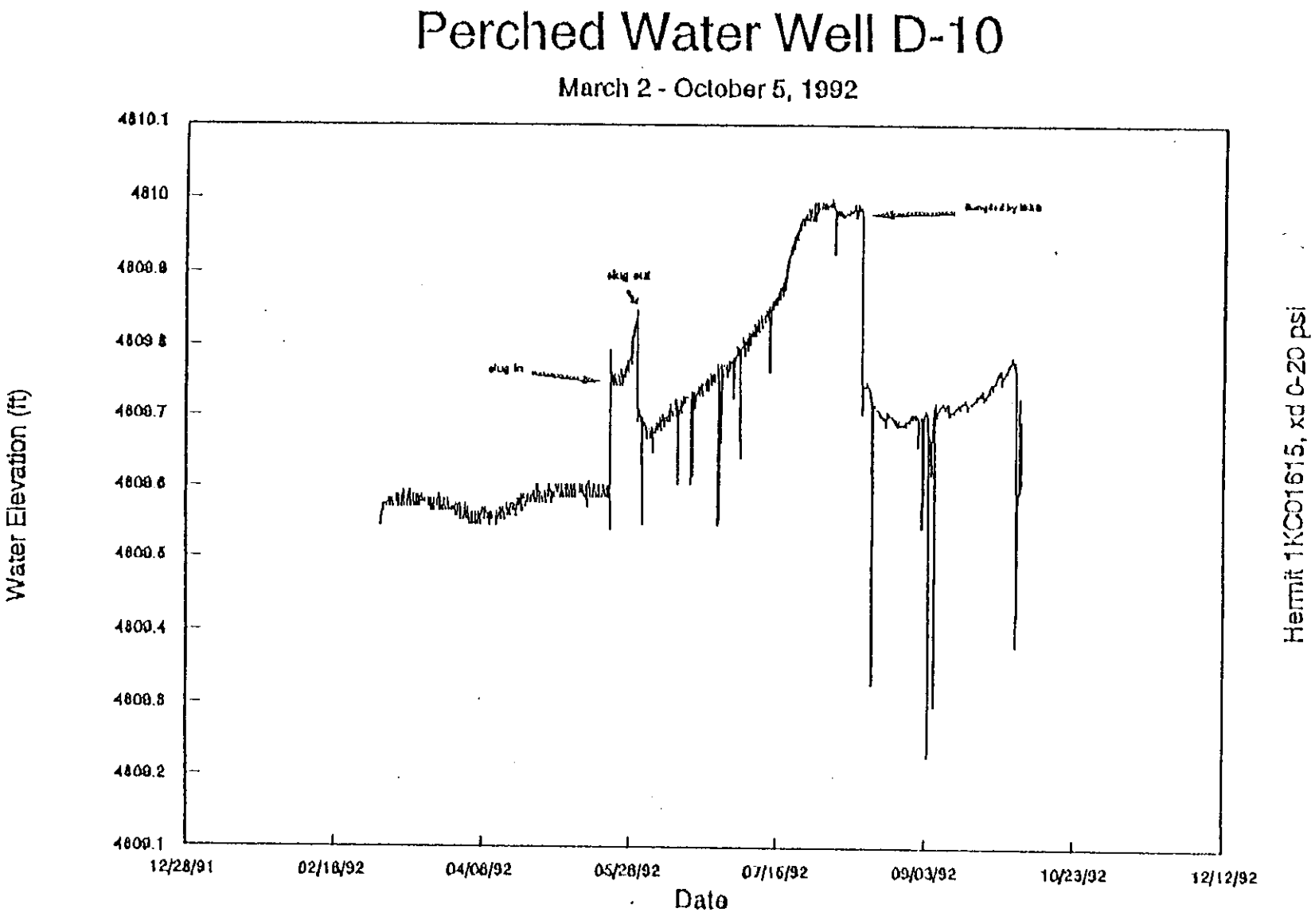

Figure 22. Water level in Well D10, 1992 (Hubbell, 1992).

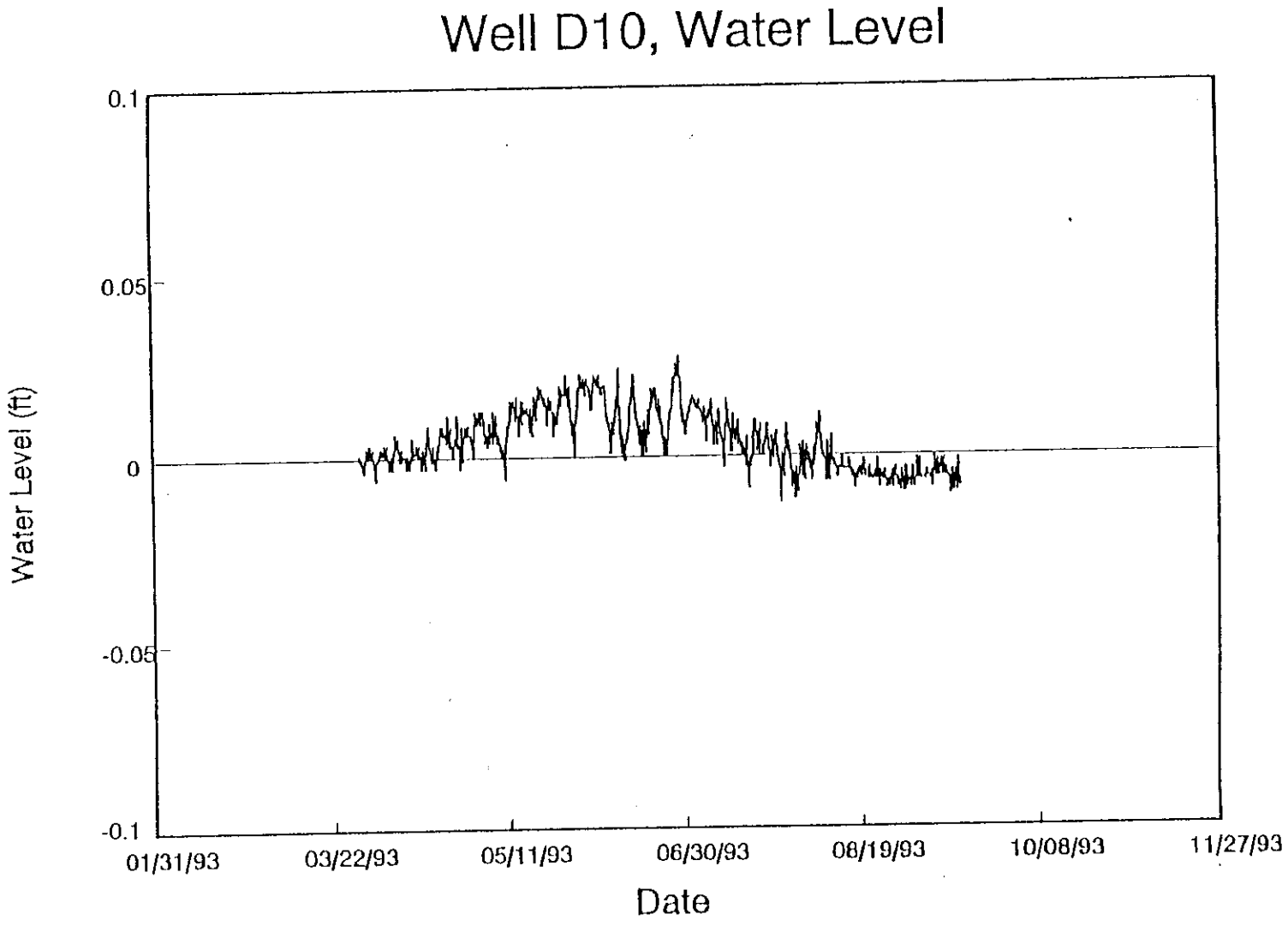

Figure 23. Water level in Well D10, 1993 (Hubbell, 1993).

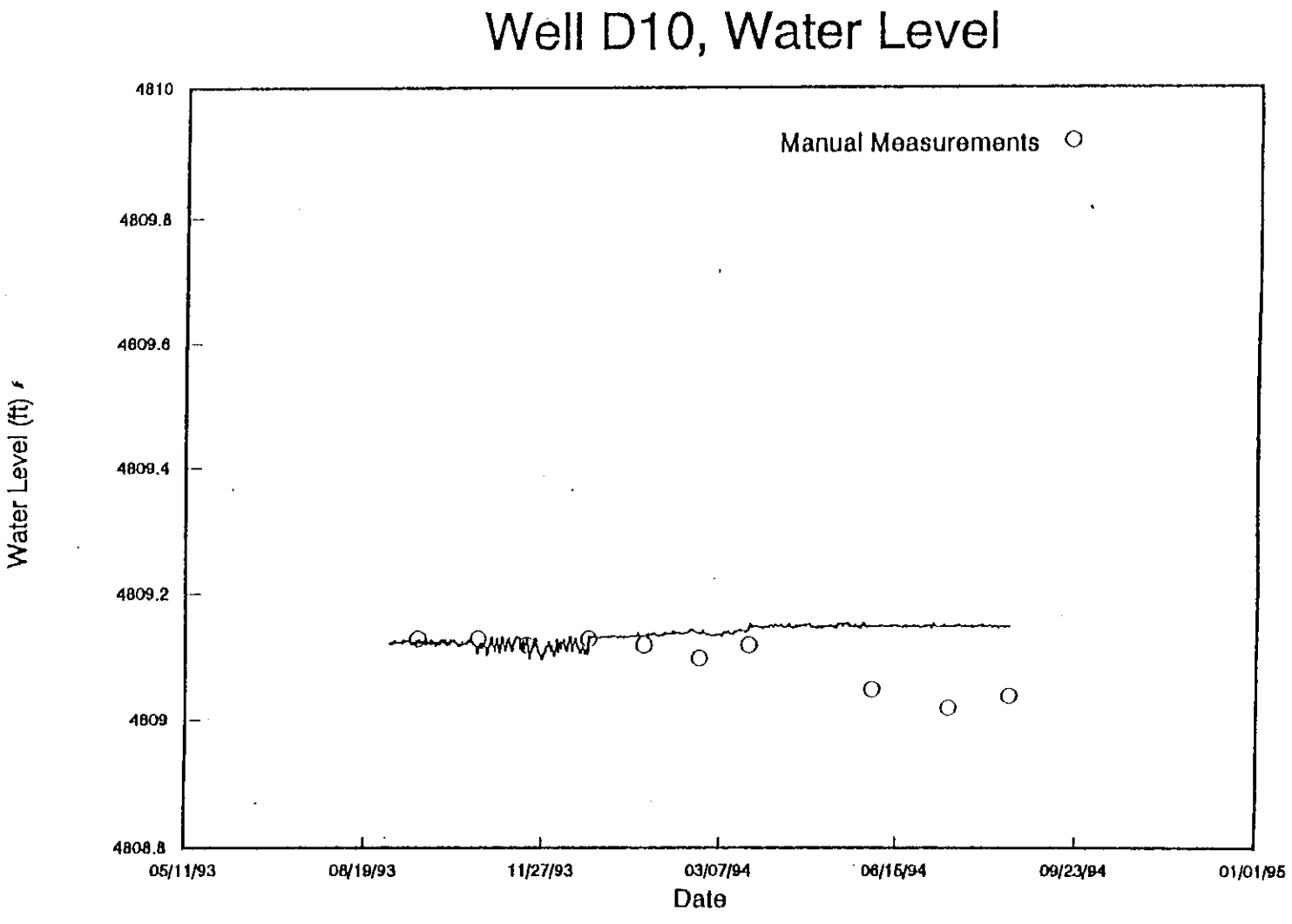

Figure 24. Water level in Well D10, 1993-94 (Hubbell, 1994).

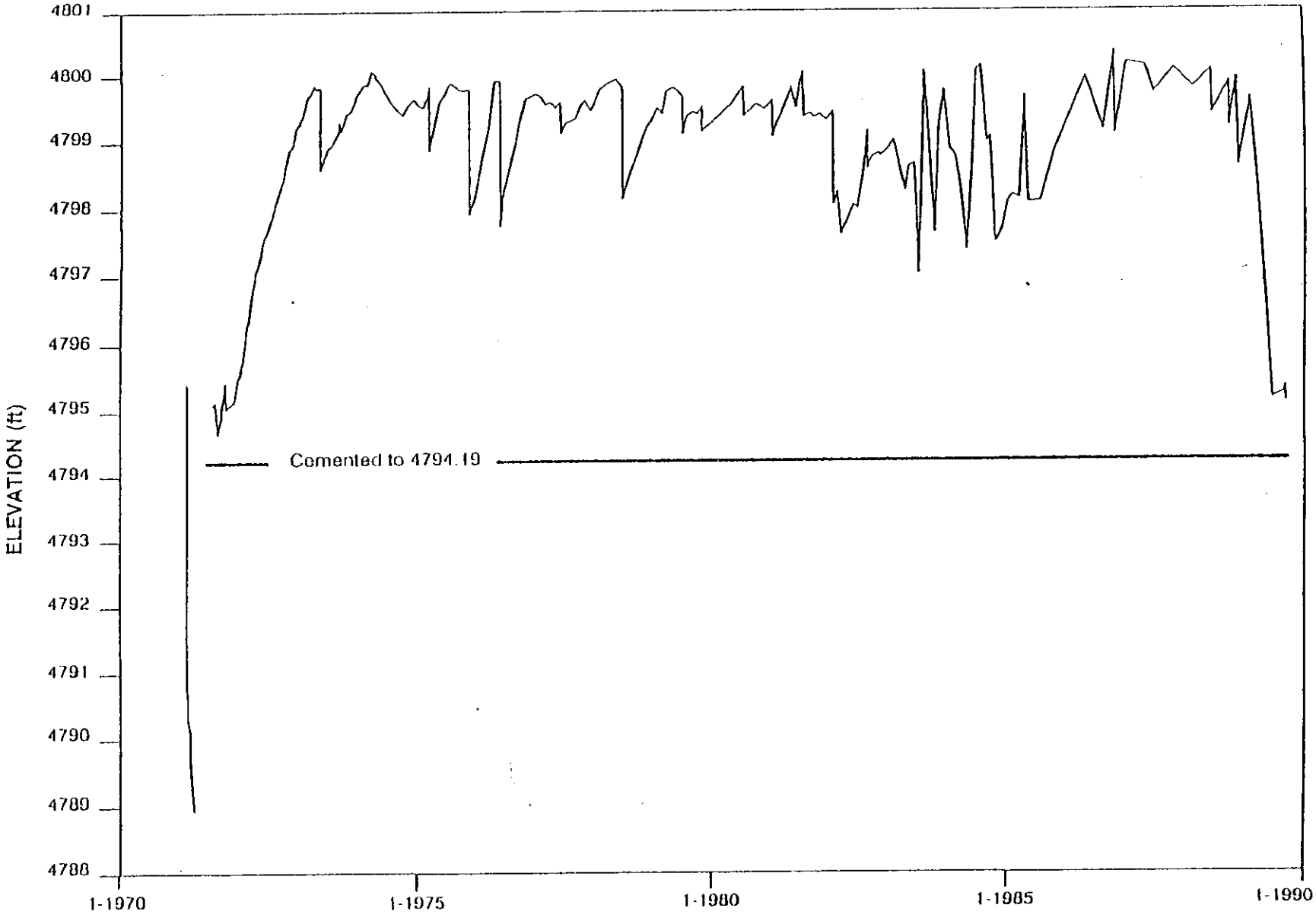

Figure 25. Water level in USGS 92, 1970-1990 (Hubbell, 1990).

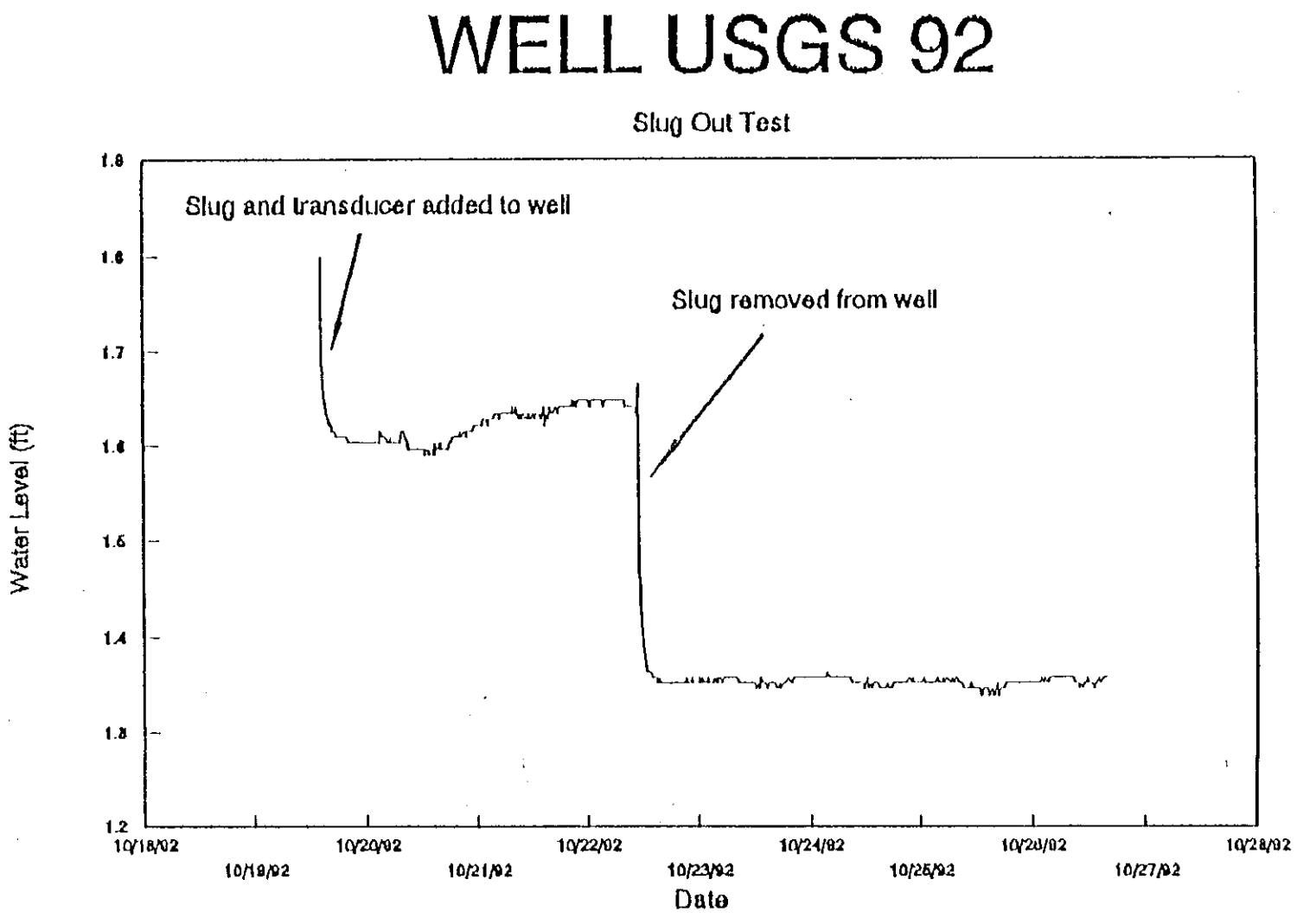

Figure 26. Water level in USGS 92, 1992 (Hubbell, 1992).

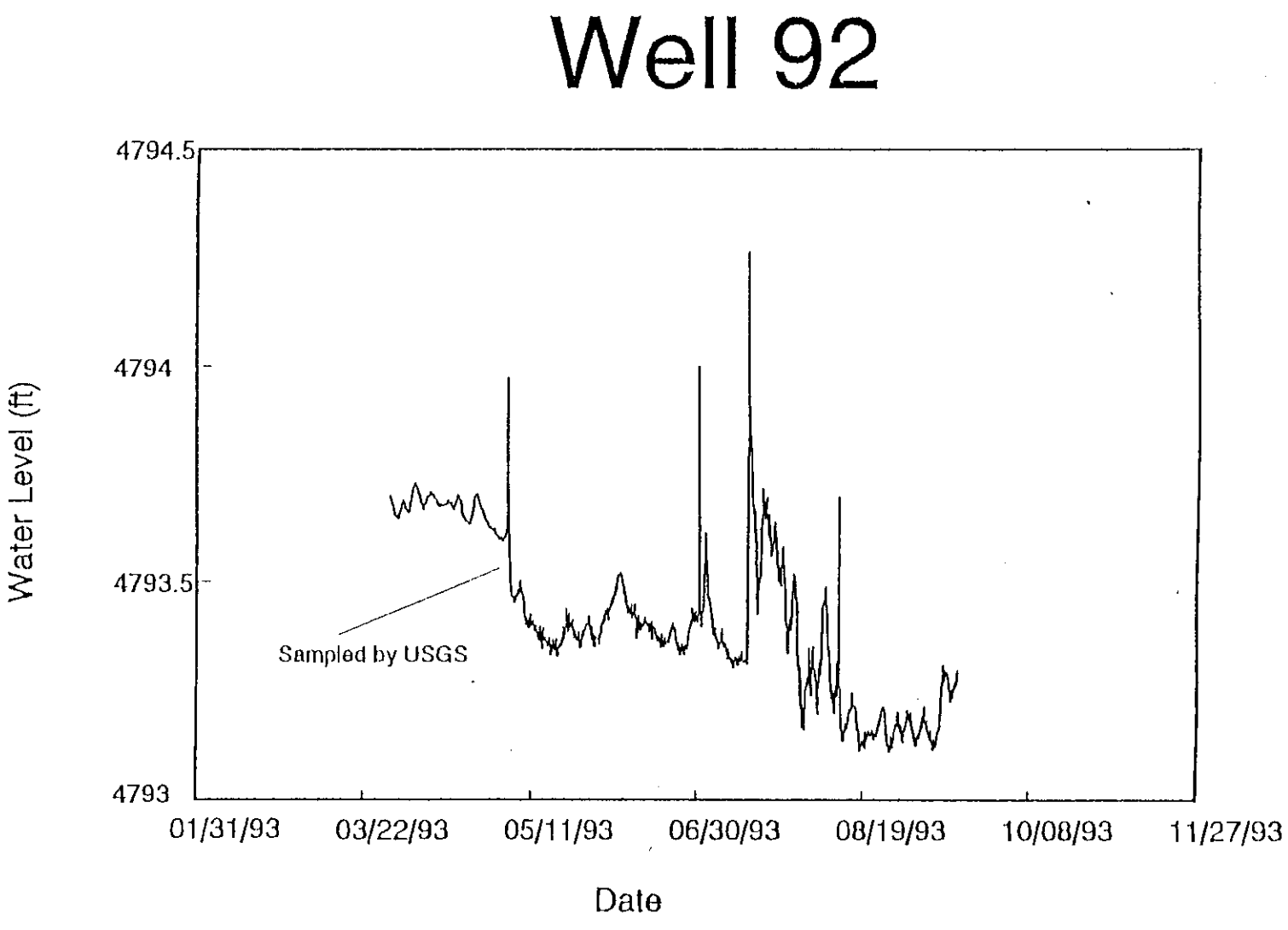

Figure 27. Water level in USGS 92, 1993 (Hubbell, 1993).

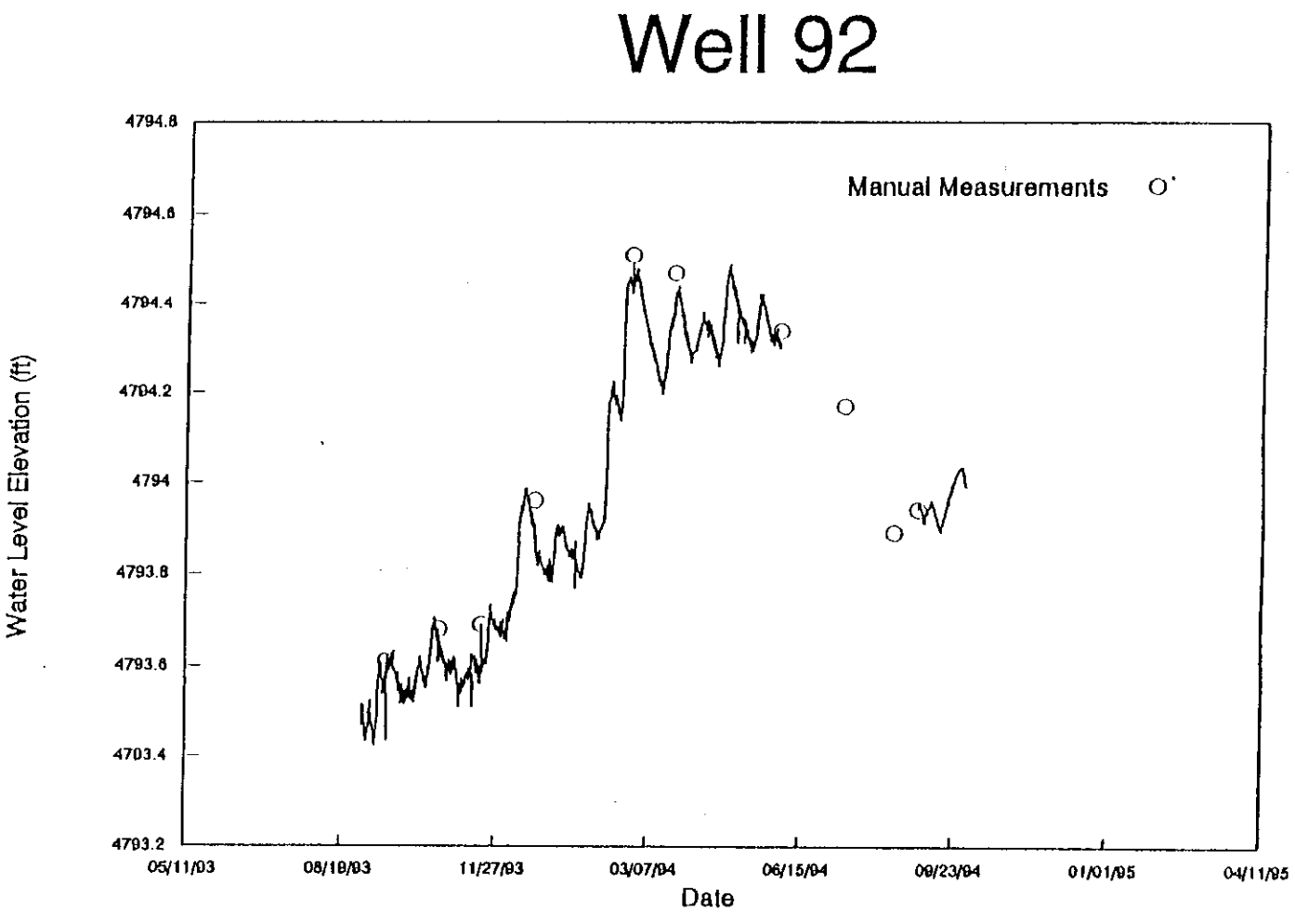

Figure 28. Water level in USGS 92, 1993-94 (Hubbell, 1994).